VOLUME LIII NUMBER SIX

THE NATIONAL GEOGRAPHIC MAGAZINE

JUNE, 1928

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PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
HUBBARD MEMORIAL HALL
WASHINGTON, D.C.

$3.50 A YEAR 50c THE COPY

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

TO carry out the purposes for which it was founded forty years ago the National Geographic Society publishes this Magazine. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by an addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over $50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization waning when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole.

NOT long ago The Society granted $25,000, and in addition $75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society is conducting extensive explorations and excavations in northwestern New Mexico, which was one of the most densely populated areas in North America before Columbus came, a region where prehistoric peoples lived in vast communal dwellings and whose customs, ceremonies, and name have been engulfed in an oblivion.

TO further the important study of solar radiation in relation to long-range weather forecastings, The Society has appropriated $60,000 to enable the Smithsonian Institution to establish a station for four years on Mt. Brukkaros, in Southwest Africa.

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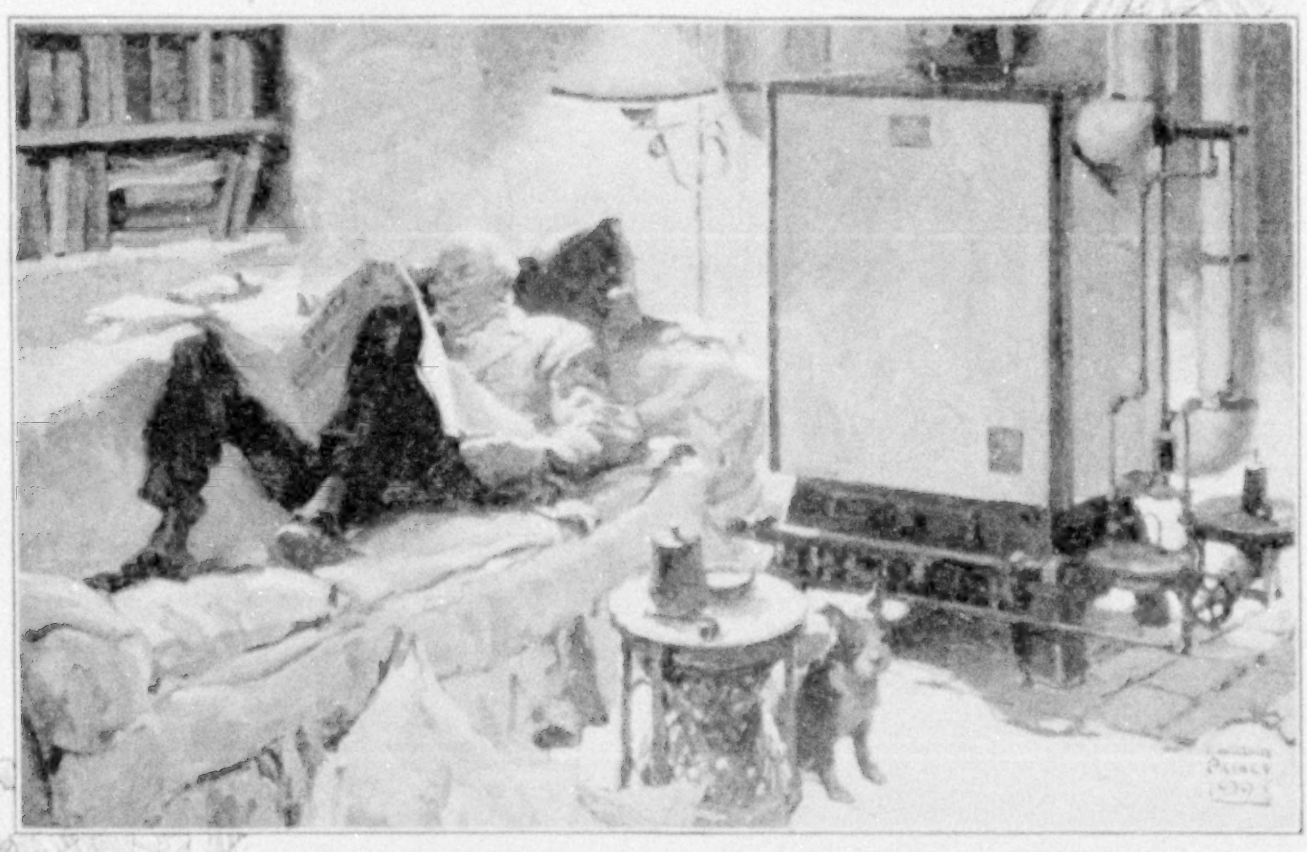
Where "the Pup is Furnace Man"



BRYANT Automatic Gas Heating ends a family's slavery to the furnace room. All winter long the only effort required to secure abundant, even warmth is the winding of a good 8-day clock. A pup can do all of the furnace tending!

All day long, without a finger lifted, the warmth of the home stays within a single thermometer-measured degree of the temperature you select. As you retire, the temperature drops—automatically—and rises again before you do. The family in the Bryant Gas heated home enjoys cozy, lazy winter warmth without a single furnace care.

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The purchase of a Bryant Gas Heating plant can be arranged on the pay-as-you-enjoy-it plan of extended deferred payments.

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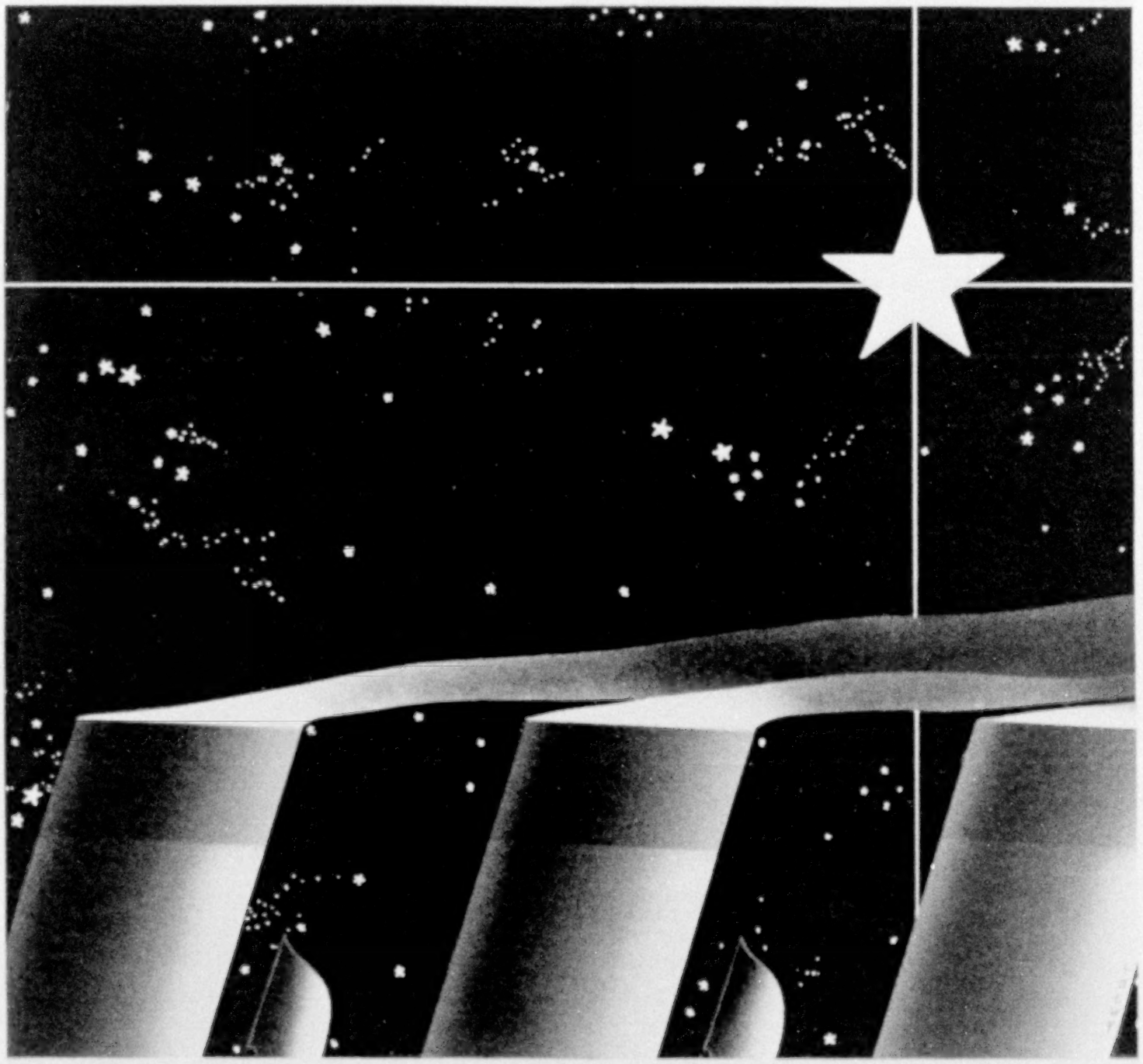

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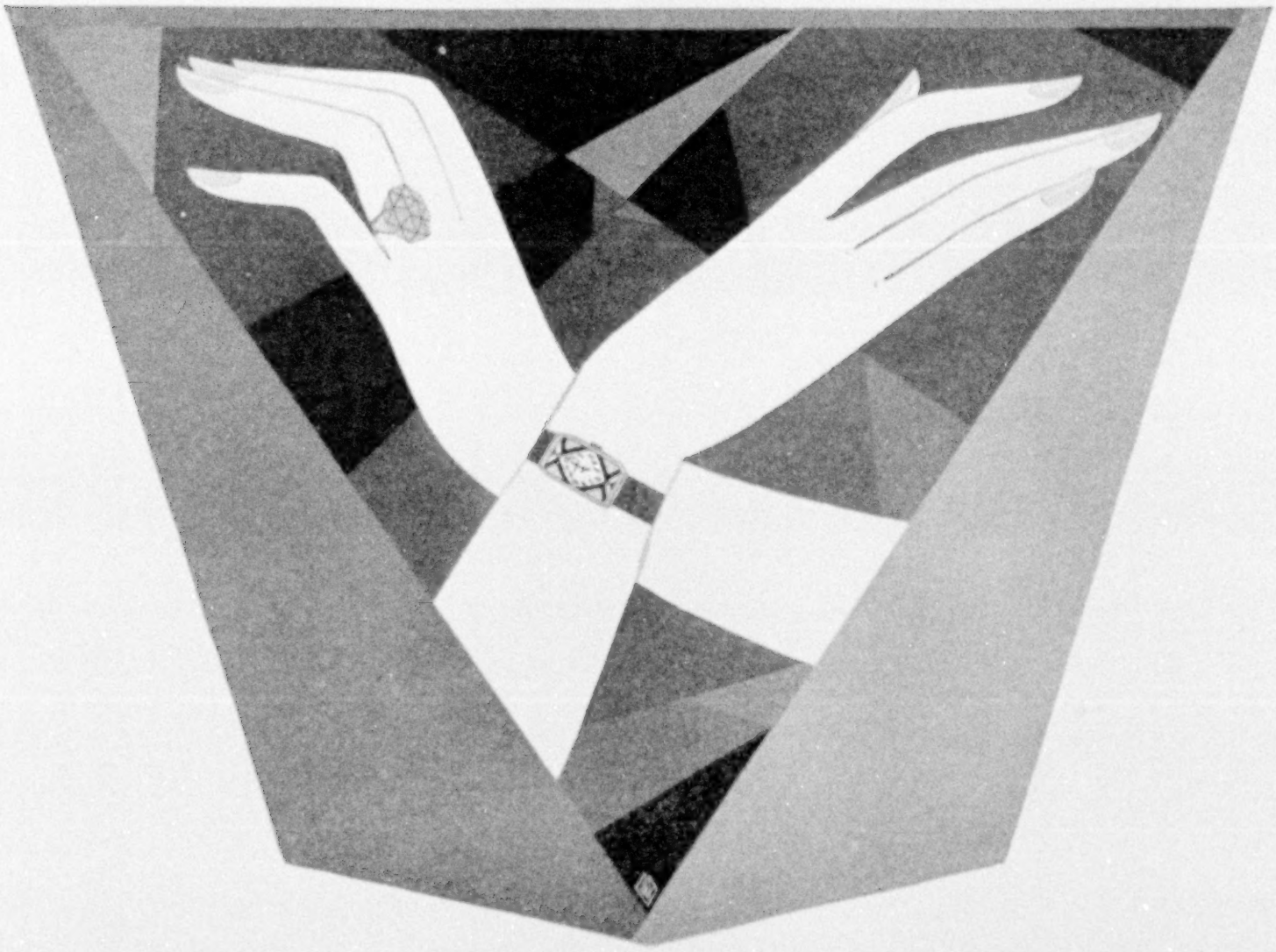
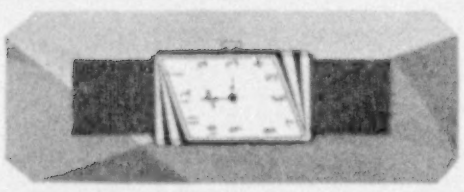


DESIGNED BY THREE FRENCH STYLISTS OF THE PARIS GRAND COUTURE MADE BY ELGIN

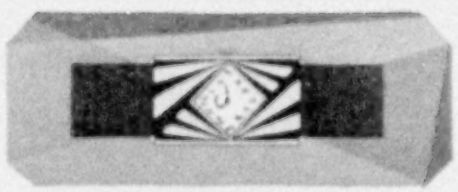
To secure watch-designs reflecting the Paris mode and manner, Elgin consulted three French stylists of the Paris Grand Couture . . . Madame Jenny, Madame Charlotte, creative mind *de la maison* Premet, Madame Agnès, *modiste très moderne.* Under the personal guidance of each of these internationally famous women a special, *moderne,* dainty wrist watch has been created . . . Never before such an exquisite watch, such a chic and styleful watch . . . such an utterly reliable and faithful watch for $35! . . . And a real Elgin! Which means a trustworthy timekeeper.

The case is fashioned with jade, black or ruby enamel . . . The movement is Elgin through and through . . . with the Elgin guarantee. The hitherto undreamed of low price is only possible because of Elgin efficiency and Elgin's great production. These Elgin Parisienne models are now on display at all jewelers at $35 . . . Elgin National Watch Company, Elgin, U. S. A.

©Elgin, 1928

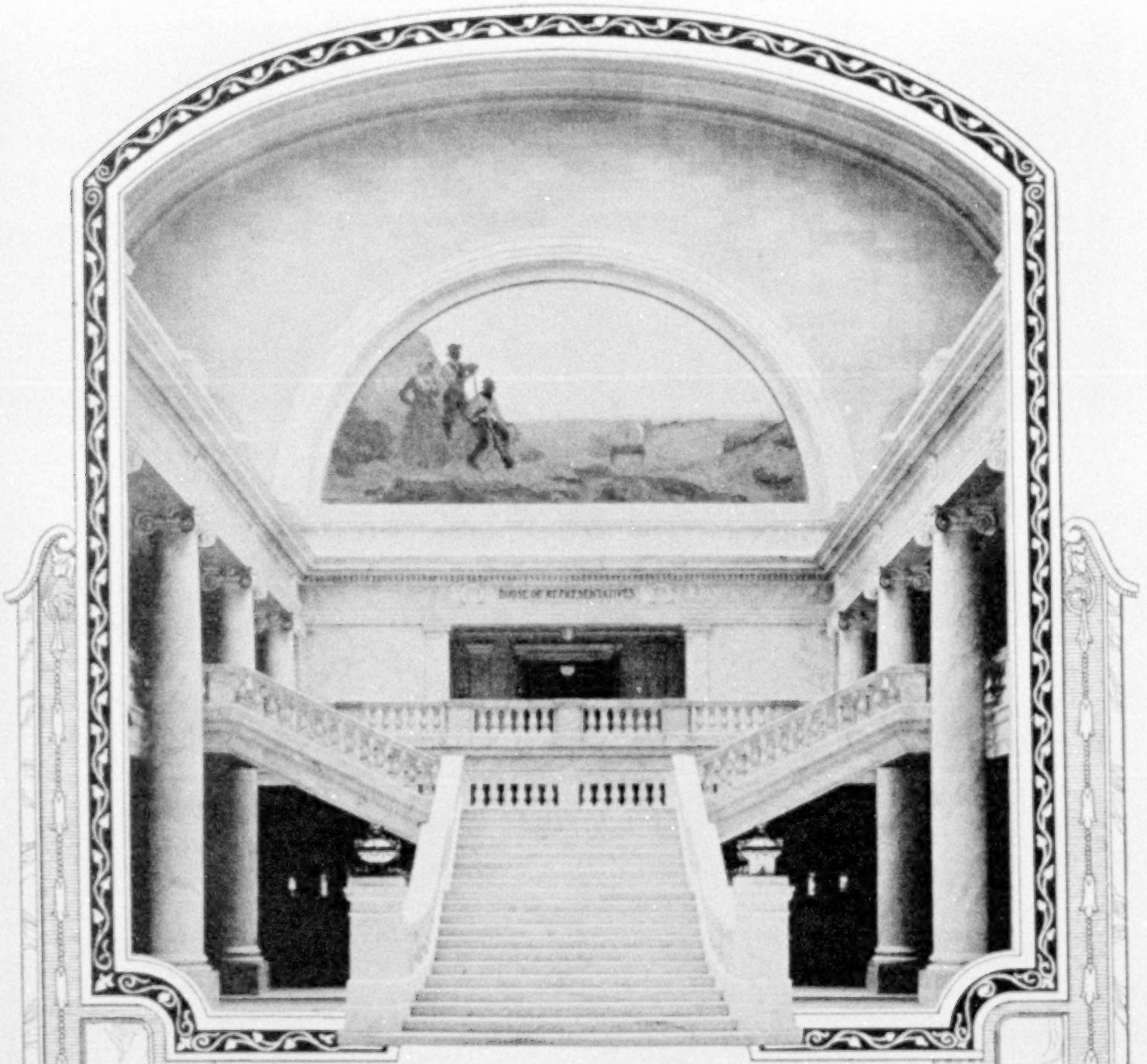


THE PREMET . . . When Premet gave that internationally famous frock *La Garçonne* to the world, smart women of the *haut monde* blessed the name and wore the frock. This chic house has now sponsored this new Elgin model. A genuine Elgin. $35



THE MADAME AGNÈS . . . Throughout the smart fashionable world the name of Madame Agnès, *la modiste,* stands for one thing, *chic, très moderne!* Now she has given America her conception of a wrist watch . . . enamel encrusted, delicately modeled. $35

THE MADAME JENNY . . . In this exquisite wrist watch, the great Paris *couturière* has caught the exact spirit of the modern manner. The case is fashioned with jade, black or ruby enamel. The movement is Elgin, which means watch accuracy the world over. $35



Interior of Utah State Capitol, Salt Lake City
RICHARD K. A. KLETTING, *Architect*

THE full sweep of marble stairs, bordered by graceful balustrades, and the strength of lofty columns endow the interior of the Utah Capitol with a beauty and dignity that is almost awe-inspiring.

From far-away quarries in Georgia came the delicate gray marble, with its beautiful veining and its marvelous strength, that adorns this interior.

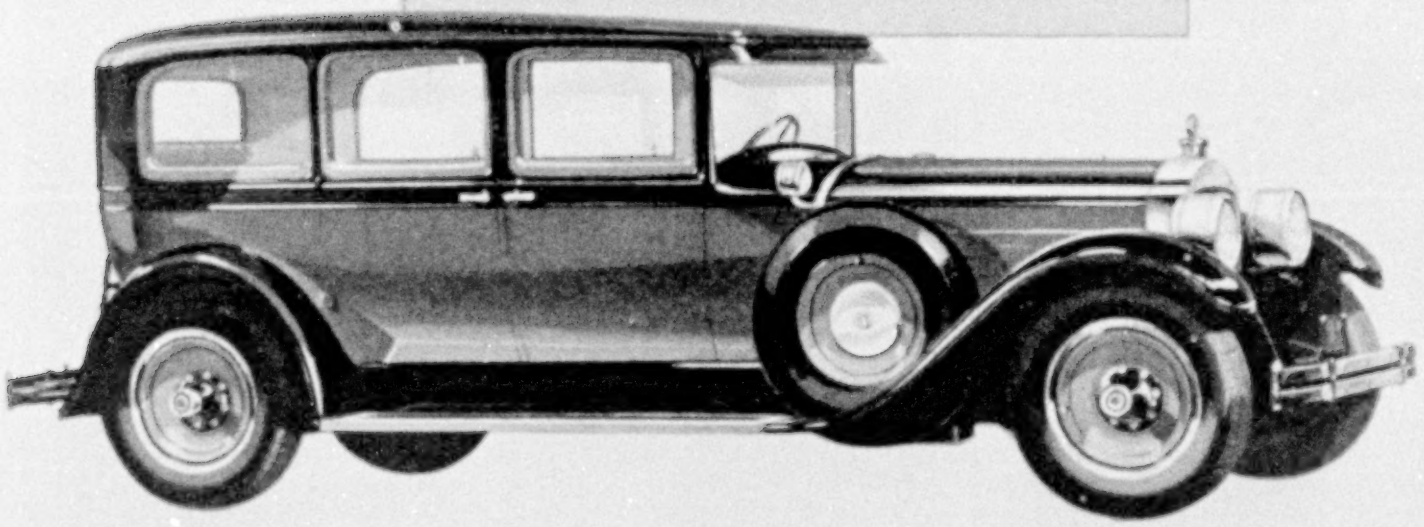
Many of the nation's most imposing buildings are of Georgia Marble. Its great natural beauty combined with its enduring strength make it the logical choice of those who build for all time.

The Georgia Marble Company
Tate, Ga.

Bona Allen Building, ATLANTA
1328 Broadway, NEW YORK 456 Monadnock Bldg., CHICAGO

GEORGIA · MARBLE

Repoussé, the ancient art of tracing designs upon metal by hammering from the back, was extensively used in ornamenting richly wrought armour



THE famed beauty and grace of today's Packard reflect far more than the ability of Packard body designers. Graceful lines, conceived by artists, are possible in the finished car through the modern perfection of tools and methods for the pressing of metal.

It seems but a few years ago when every Packard body was individually hammered out by wasteful hand work—the same method of beating flat metal sheets into useful and ornamental forms which has been practiced since the earliest times.

Today, great presses, some of them exerting a thousand tons of force, mold Packard body panels, fenders and other parts from sheets of special steel. The costly dies instantly form more beautiful and accurate shapes than weeks of the most expert labor could possibly produce.

Packard is proud of the large part it has played in the development of metal-working tools which contribute so much to Packard beauty and long life—and aid in making Packard ownership available to additional thousands.

Packard cars are now priced from $2275 to $4550. Individual custom models from $3875 to $8725, at Detroit

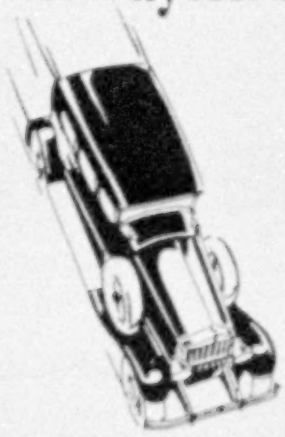
PACKARD

ASK THE MAN WHO OWNS ONE

STABILIZED—to stand the terrific strains and speeds of modern motoring.

Look 10,000 miles ahead when you buy that *new* car-

—and *equip now* with Dayton Stabilized Balloons



THE tires on that new car may look fine now. But how will they look when your car is just beginning to give you its best performance? Are they tires to which you would willingly trust your life after they have pounded away on the road for ten thousand miles or more?

Will they have sufficient life and stamina to stand the strain of quick starting, fast traveling, sudden turning, instant stopping—or will you be in constant fear of a weakness in your tires—an untimely puncture or blow-out?

Dayton Stabilized Balloons are still in their prime when ordinary tires are entering the danger zone.

There is a margin of safety of thousands of miles in these amazing tires. Extra thousands of miles you may never use. Because Dayton Stabilized Balloons are still going strong when the average man trades in his car. Yet, though you run them only 5,000 miles or many times 5,000 miles, this extra safety and trouble-free service make them the most economical tires you can buy. *The extra mileage is added value.*

THE DAYTON RUBBER MFG. CO.
Dayton, Ohio

Dayton STABILIZED BALLOONS

Makers of Dayton Thorobred Extra-ply Cords for large diameter wheels, the pioneer low air pressure tires of America. Also makers of famous Dayton Maximaire Fan Belts, chosen by 85% of America's automobile and truck manufacturers as original equipment.

Dayton Thorobred Tubes—famous companions to Dayton Tires

Chateau Frontenac

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the only walled city of the New World

Dominating the stately St. Lawrence, rises the still statelier rock of Old Québec, only survival in America of the walled medieval cities of Europe. Along its front runs Dufferin Terrace . . . below its ramparts rise the peaked roofs of the Lower Town, many houses three hundred years old . . . below that, again, the old-world market where goelettes unload fish and sheep and vegetables from the down-river farms . . . where farmers coax you to buy in Norman French, and grandmères display their winter weaving for sale. Dominating rock, town and terrace, rises Chateau Frontenac, a Norman castle, housing one of the great hotels of the world. Behind it rises the ancient citadel . . . for Québec has always been garrisoned. Out beyond stretch the Plains of Abraham . . . the Montmorency golf courses . . . the smooth wide roads to Ste. Anne de Beaupré and Indian Lorette . . . the wooded side roads and Norman farms. A romantic country, at its loveliest in June . . . visit it now! Only a 600-mile run from New York by motor, through beauty all the way. Full information and reservations at any Canadian Pacific District Office as listed, or write Chateau Frontenac, Québec, Canada.

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Reproduction from a painting made on the estate of Charles M. Schwab, Loretto, Pa., by Frank Swift Chase

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73% of Davey clients paid less than $100 each

In 1927 Davey Tree Surgeons served 17,417 clients, from Boston to Kansas City and from Canada to the Gulf. The volume of business last year was $2,400,000.

And yet for this expert, reliable tree service—

9726 clients paid less than $50.00 each
2944 paid from $50.00 to $100.00 each
2372 paid from $100.00 to $200.00 each
1687 paid from $200.00 to $500.00 each
And only 688 paid over $500.00 each

Davey Tree Surgeons are easily available. They live and work in your vicinity. There are nearly 900 of them now—all carefully selected, thoroughly trained, properly disciplined and supervised, and held to a high standard of service.

The business of The Davey Tree Expert Company has trebled since 1923, as follows:

Volume in 1923	$ 800,000
Volume in 1924	$1,200,000
Volume in 1925	$1,600,000
Volume in 1926	$2,000,000
Volume in 1927	$2,400,000

This steady and substantial growth does not prove everything, but it does indicate a high measure of value and satisfaction. How else could this personal service business be maintained and made to grow? More than half the business each year comes from former clients.

Every hour of every day 900 Davey Tree Surgeons are working on probation. Every client reserves the right to stop the work at his discretion. They must give satisfaction or they would have no employment. They will please you also.

Davey Tree Surgeons are local to you. Write or wire, Kent, Ohio.

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Send for local representative to examine your trees without cost or obligation

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JOHN DAVEY
1846-1923
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for making your vacation movies!

The new Bell & Howell

Filmo 75

"Watch-thin" as compared with others. Flat, handy, fits in a pocket. Attractive new price. Get details

HERE is the camera that at last brings within reach of the average family all the pleasure, entertainment and satisfaction of having *quality* motion pictures. It is the new Bell & Howell Filmo 75, costing *one-third less* than the famous Filmo 70, yet retaining many of its features of adaptability and precision.

You hold the Filmo 70 in one hand, the index finger falling naturally on the automatic release button—look through the spy-glass viewfinder concealed within the frame—press the button. That's all there is to do. What you see, you get—with mirror-like fidelity — motion and all.

The Filmo 75 is jewel-like in its beauty. It is "watch-thin" as compared with all others. Readily slips into the coat pocket. No shutter adjustment, no focus, no tripod—so simple a child may successfully operate it. Ideal for field, travel, vacation and sport use. Filmo 75 is built to the same high standards of quality as the Bell & Howell

"What you see, you get"

FILMO 70

The most flexible and highly perfected movie camera made at any price for amateur use. Described in free booklet "Home Movies of the Better Kind." Write for it.

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Both Filmo cameras use Eastman Safety Film (16 mm.) in the yellow box, obtainable at practically all stores handling cameras and supplies. First cost covers developing and return postpaid to you. Then you are ready to see your own movies shown in your own home with the Filmo Projector —with the theatre *depth, beauty* and *brilliancy* always characteristic of Bell & Howell motion picture equipment.

This summer have a Filmo 75 or 70 for your vacation—for taking movies of the children—for the thousand other pleasant things. See your Filmo dealer. Meantime, mail the coupon for further information.

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Please mail full descriptive information on your new Filmo 75 and send name of nearest store where I may examine and try it.

Name.....

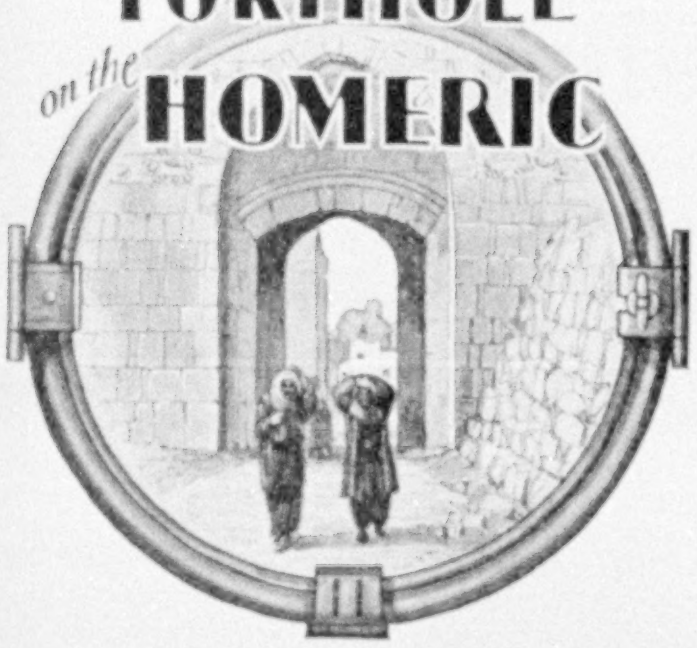
Address.....

City..... *State*.....

BELL & HOWELL

Filmo

THROUGH A PORTHOLE on the HOMERIC



JERUSALEM—Pilgrims of many faiths pouring through the Jaffa Gate, the Damascus Gate, to the Church of the Holy Sepulchre, the Dome of the Rock, the Jews' Wailing Place... Through narrow cobbled streets reverberate the sounds of auto horns and camel's bells . . . A cloud of dust near the Mount of Olives reveals a shepherd, carrying a newborn lamb, followed by his flock,—an unforgettable picture on the

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Read how Miss Marjorie Sidney has kept her teeth sound and lovely for 14 years with the daily use of this one cleansing cream

NO wonder men pay tribute to a smile like this. Brilliant . . . flashing . . . glorified by lovely teeth since childhood days.

Miss Sidney when she started using Colgate's.

For 14 years Miss Marjorie Sidney has used but one dental cream . . . and today her teeth are more beautiful than ever.

They flash a clear message to you and everyone else anxious to keep teeth healthy and attractive for years to come.

She gives much of the credit to Colgate's. "A daily cleansing with this famous dental cream . . . and a trip to the dentist every six months"—that's her secret.

Not an unusual record

In this country, and in foreign countries the world over, you will find thousands and thousands of men and women who began using Colgate's ten, fifteen, even twenty years ago, and whose teeth today are exceptionally sound and beautiful.

Many of these people are grateful enough to write to us—sincere, unsolicited reports because they are proud of the soundness and attractiveness of their teeth. There is nothing mysterious about these enviable results. The men and women fortunate to secure these results did nothing that you cannot easily do yourself.

They visited their dentists for periodic inspections. And they used Colgate's Dental Cream.

Most popular dentifrice

Choose your dentifrice on the basis of results. Follow the lead of those who have already kept their teeth sound for years. Simply adopt for your own use the dentifrice most popular among people with well preserved teeth.

Also, wouldn't it be an immense satisfaction to know that the dentifrice you were using was the one which dentists recommend most frequently?

So, for lovely teeth . . . for teeth that make your smile the social and business asset that it should be . . . ask your druggist today for Colgate's.

CLEAN

Years ago we set out to make the best dentifrice possible. We interviewed leading dental authorities. They told us that the one thing a dentifrice should do is to clean teeth. We then produced Ribbon Dental Cream—designing it to do that one thing superlatively well. It is not medicated, because all experiments in the meantime have sustained the original principle that cleansing is the only thing a dentifrice can do.

Colgate & Co., Dept. 205 F, 595 Fifth Ave., N. Y.
Please send me a Free sample of Ribbon Dental Cream.

Name .....

Address .....

Just jot your name and address on the coupon, tear out and mail today. We will gladly mail you a trial tube of Colgate's to test in your own home.

ACROSS THE FENCELESS SKY

WHEN forest fires or tornadoes strew the paths of civilization with wreckage and suffering . . . when levees melt away before uncontrollable floods, and entire countrysides are inundated . . . when blizzards smother city and country under paralyzing burdens of snow and sleet, *where does man look first for help from his fellow man?*

Upward! For across the fenceless sky first aid will come!

Florida, storm-swept . . . Yokohama and Tokyo, shattered by earthquake and blasted with flame . . . the Mississippi Valley, sunk in its floods . . . and New England, ravaged with sleet storms and turbulent waters . . . *all turned to the sky to re-establish communication with the outer world.*

Everywhere above the earth, it seems, planes are flying on errands of mercy, drawing mankind closer together in bonds of sympathy and understanding. Not only in the service of stricken communities, but in the service of individuals who otherwise would be beyond the help of man.

For among the small items of the daily news we read of a child born three thousand feet above the dim coast of the Carolinas, as its mother is being carried to a mainland hospital . . . of a surgeon dropping from the sky through the rack and darkness of a north Pacific gale to save a wounded woman in Alaska . . . of a plane lifting a baby from a jungle village to the safety of Ancon Hospital in Panama, 250 miles away . . . of first-aid experts flying with their equipment from Washington to rescue entombed miners in Alabama. . . .

So soon has this astounding miracle of man's conquest of the sky become an accepted fact of every-day life!

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universities of another . . . from the industrial centers of one country to the markets of a neighbor? . . .

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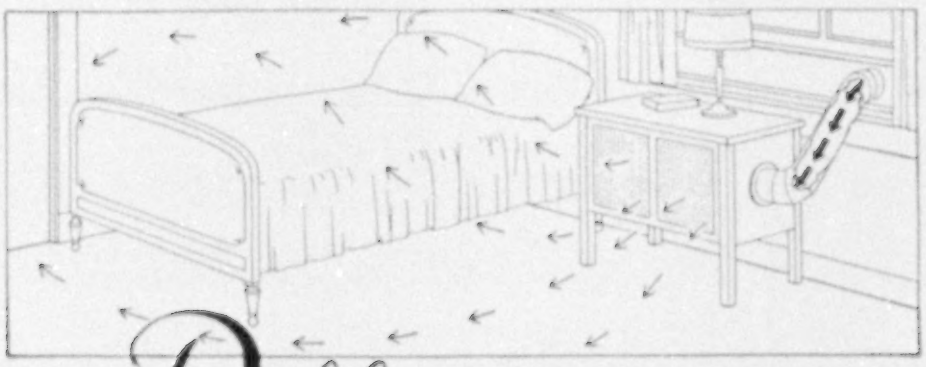

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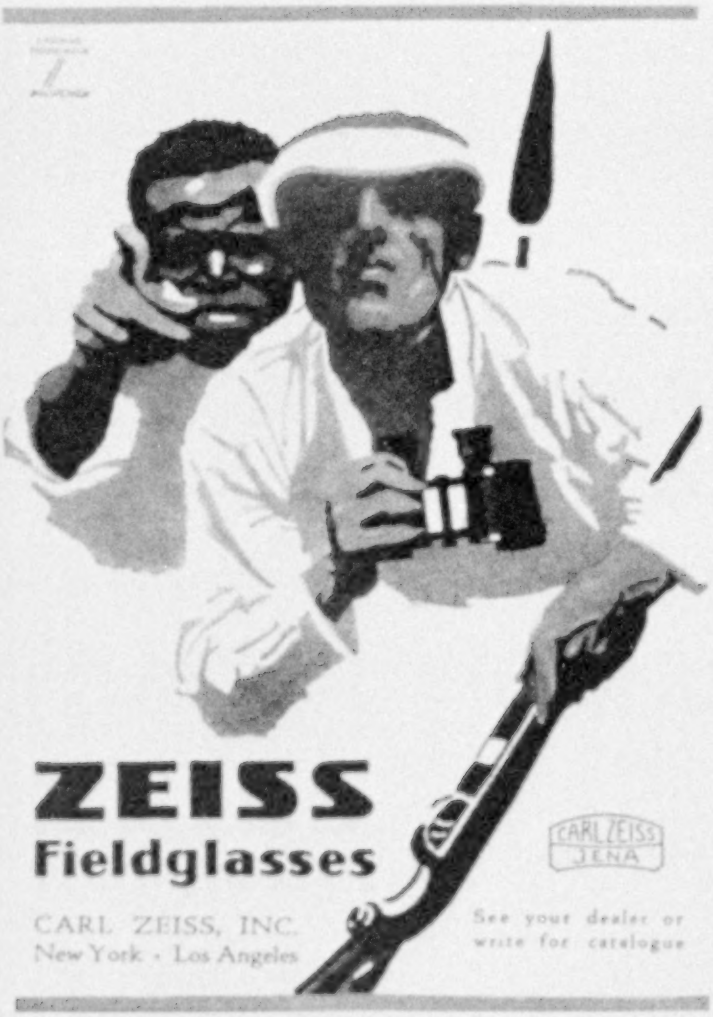

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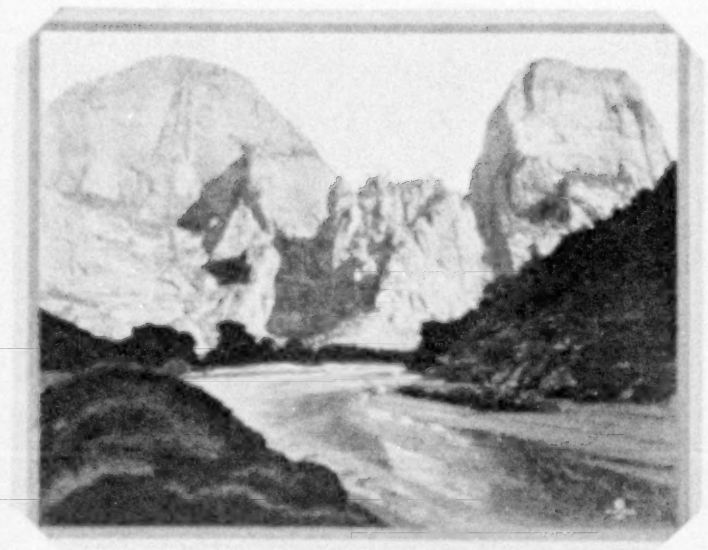

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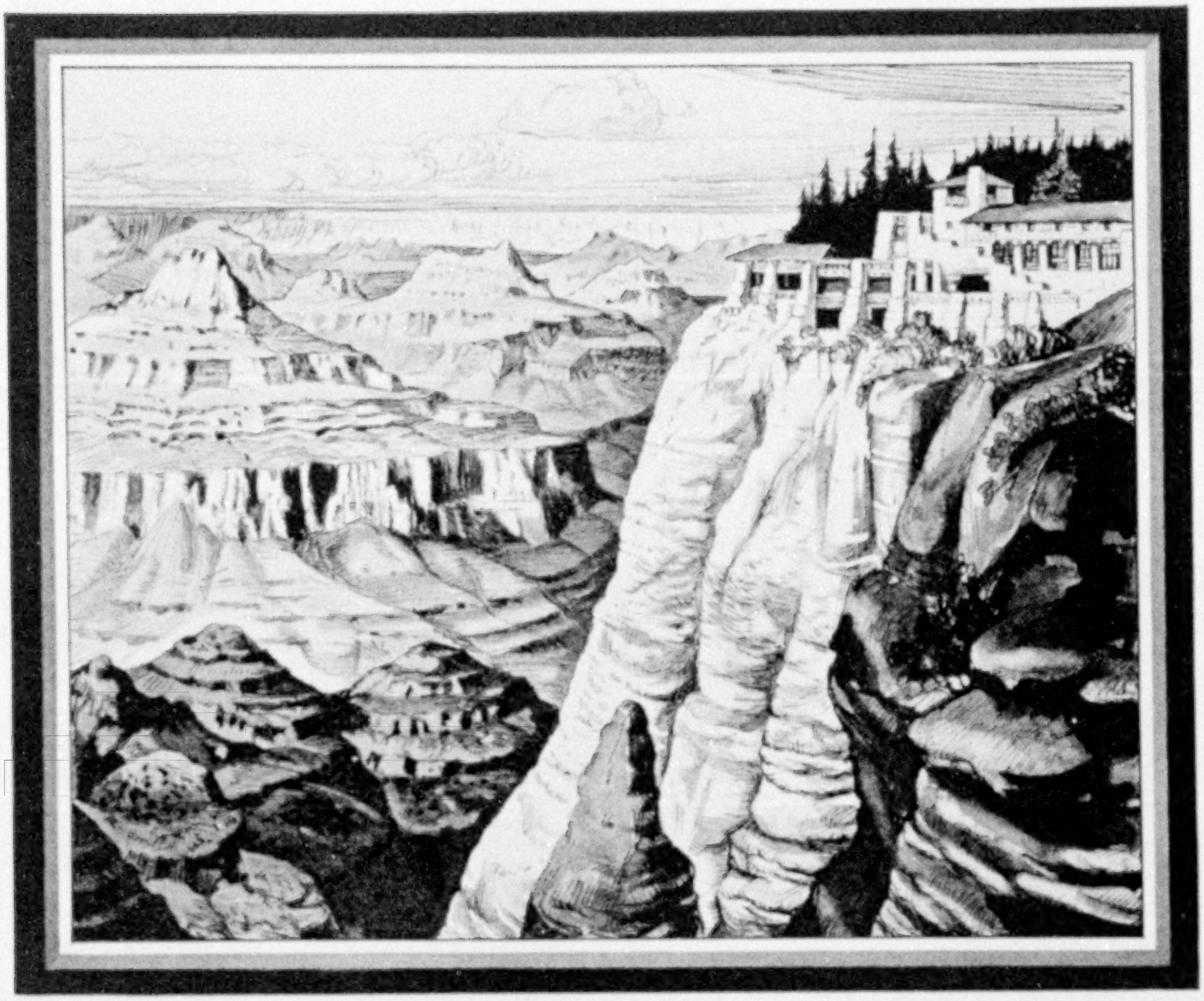

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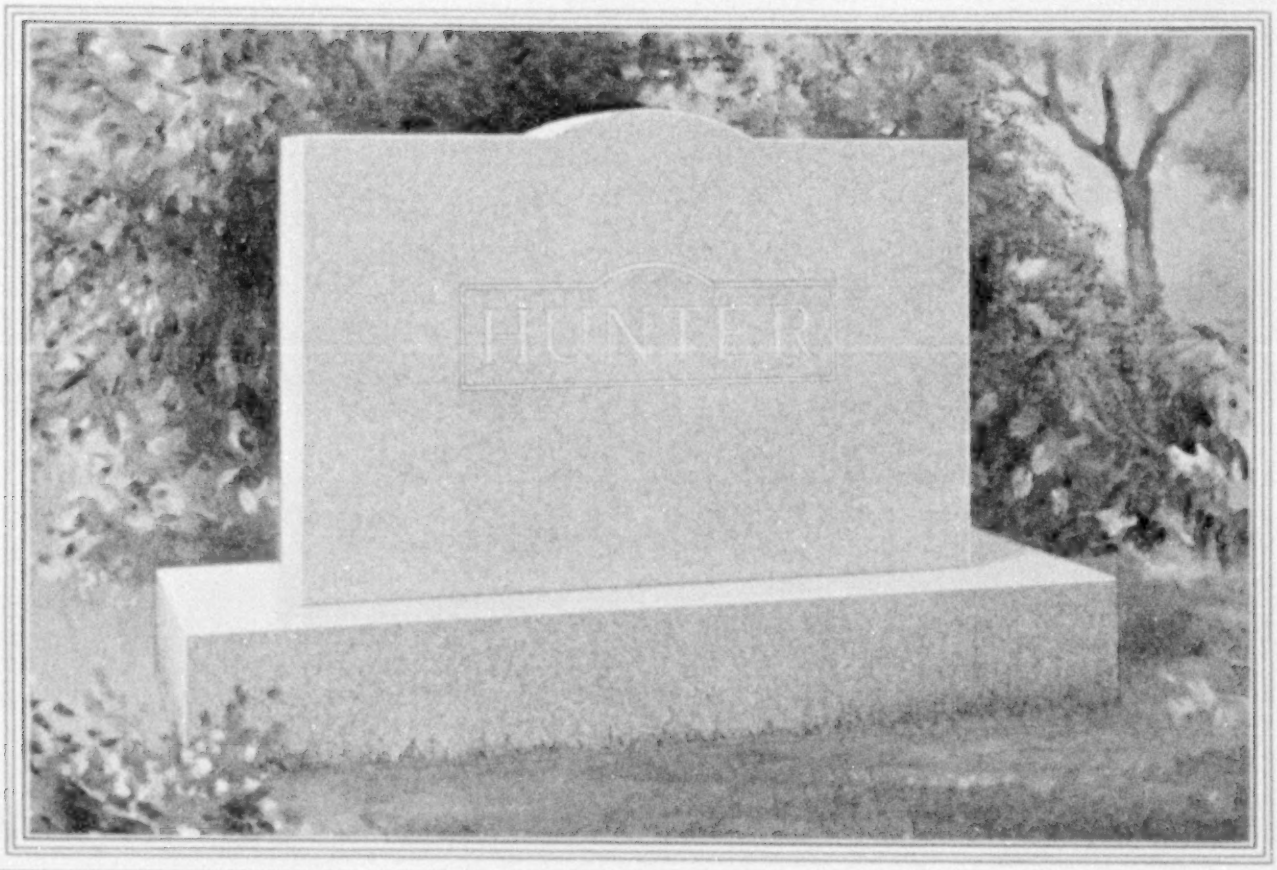

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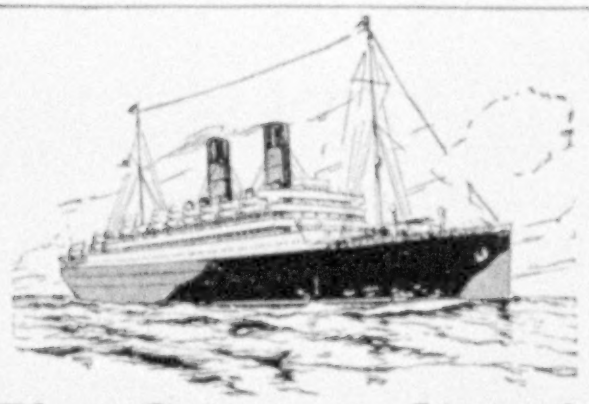

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But you can avail yourself of protection against dread Pyorrhea and other gum infections. Have your dentist examine teeth and gums at least once every six months. And, morning and night, every day, brush teeth and gums with a dentifrice that is more than a toothpaste—Forhan's.

Without the use of harsh, dangerous abrasives which often harm the tooth enamel, Forhan's cleans teeth and restores their natural whiteness. Also, it removes acids which cause decay.

In addition, it is designed for the gums. It is the formula of R. J. Forhan, D.D.S., and it is compounded with Forhan's Pyorrhea

Astringent, used by dentists in the treatment of gum infections.

If used regularly and in time, it helps to firm gums and keep them sound and healthy. As you may know, Pyorrhea seldom attacks healthy gums.

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Forhan Company, New York

Make This 10 Day Test

Lazy, lethargic gums invite disease. And the only way to keep them firm, sound and healthy is to massage them daily just as a woman massages her face to keep it glowing with youth and free from the signs of age. Forhan's for the Gums is designed for gum massaging. Make this 10 day test. Morning and night, before brushing your teeth with Forhan's, exercise your gums, closely following the directions in the booklet that comes with each tube . . . See how much better they look and feel!

Your Teeth Are Only As Healthy As Your Gums!

Forhan's *for the gums*

YOUR TEETH ARE ONLY AS HEALTHY AS YOUR GUMS

Their like will not be gathered soon again

In response to insistent demand, Victor has completed a new Orthophonic recording of the two most popular selections in Italian opera—the Sextette from "Lucia" and the Quartette from "Rigoletto."

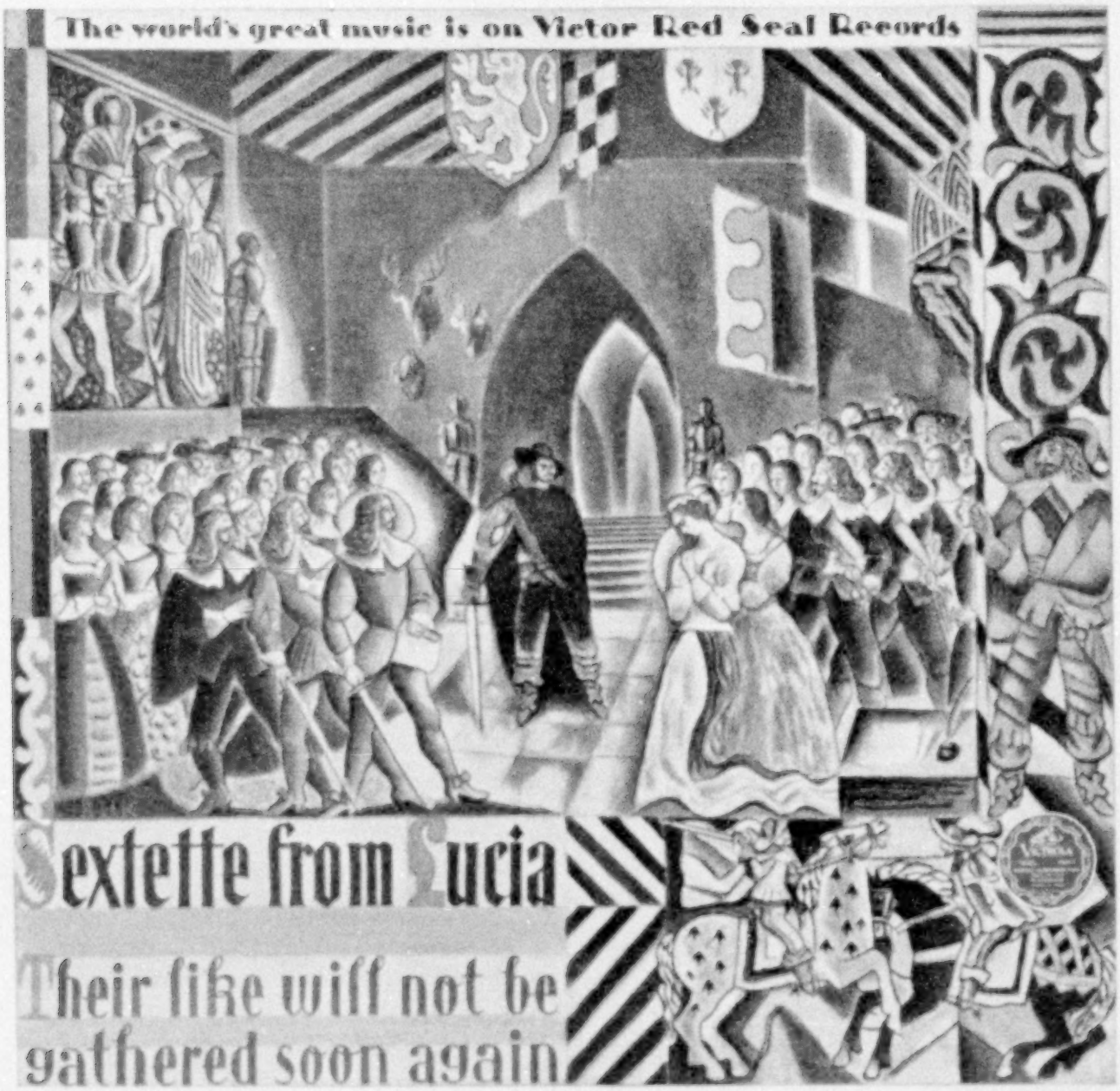
Galli-Curci . . . Homer . . . Gigli . . . De Luca . . . Bada . . . Pinza . . . where in all opera will more distinguished names be found? . . . Six of the most glorious voices of our time, brought together and united in a moment of extraordinary dramatic power and beauty.

So many generations of music-lovers have come to know and enjoy these fine old numbers, so many performances have reinvoked their charm, that they have become a part of the musical consciousness of the world. . . It would be difficult to discover two selections better fitted to fulfil the best ideals of *bel canto*—two compositions which reveal more strikingly the deep Italian genius for melodic line.

This is a feat of recording which could have been accomplished only by Victor. Under no other circumstances would it have been possible to gather six artists of such distinction at one time and place. . . . And Victor's new Orthophonic method of recording has captured the living, breathing reality of their art!

The Sextette from "Lucia" and the Quartette from "Rigoletto" are available on the same record (No. 10012). The nearest Victor dealer will gladly play you this, or any other Red Seal recording. Victor Talking Machine Company, Camden, N. J., U.S.A.

VICTOR



THE opera *Lucia di Lammermoor,* with libretto derived from Sir Walter Scott's novel, "The Bride of Lammermoor," was composed by Donizetti in 1835. Its most dramatic moment is that pictured above, from the Second Act, in which Edgar of Ravenswood faces the conspirators who have just bartered away the hand of his beloved Lucy. Swords are drawn, and furious words exchanged. The emotional intensity of the situation is vividly revealed in the famous sextette, one of the most stirring moments in all opera. The painting is by Eduard Buk Ulreich.

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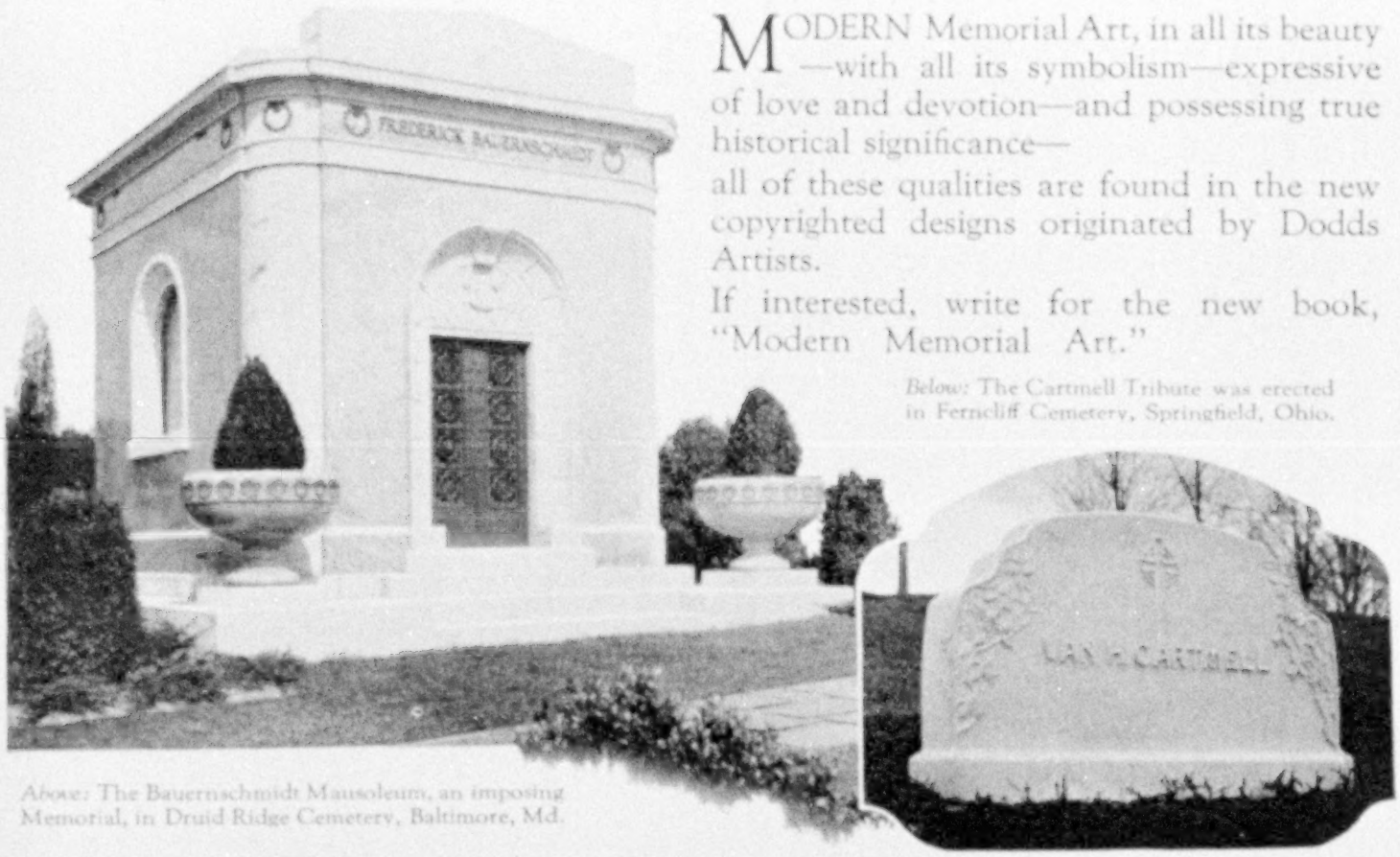
Below: The Cartmell Tribute was erected in Ferncliff Cemetery, Springfield, Ohio.



Above: The Bauernschmidt Mausoleum, an imposing Memorial, in Druid Ridge Cemetery, Baltimore, Md.

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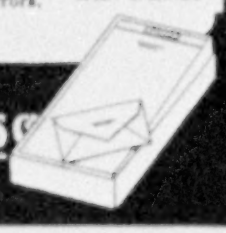

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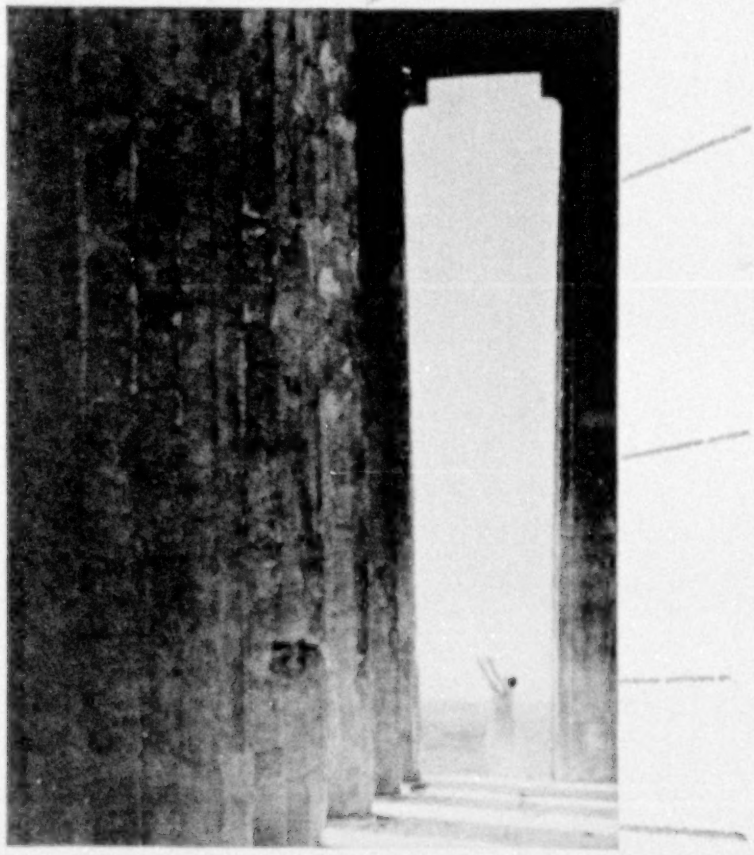
Doctor Sun

THE world's greatest physician is located 92,000,000 miles away. He is Dr. Sun. And the one great medicine that he sends is sunlight. On bright, sunny days his free dispensary is open to everybody, everywhere. But in northern latitudes, his treatments—generous applications of ultra-violet rays—are most successful during the summer months.



EDWARD J. STEICHEN

Sunlight is the finest tonic and health-builder in the world. It works its cures, mysteriously, through the skin. In sunshine there is a wonderful healing power—the ultra-violet rays. These rays are most effective from April to November and are particularly strong from June to the end of September.

Ultra-violet rays do not penetrate ordinary window glass, or clothing except the very lightest in color and weight. Nor do they penetrate, to any great extent, smoky and dust-laden atmosphere. For those who can put on bathing suits and enjoy the sunshine at a beach on ocean, lake, or river, the problem of getting sufficient ultra-violet radiation is solved. But others, too, may receive the benefits of the sun's rays by using ingenuity. At some time during the day the sunshine usually pours into some room in the home where one may lie without clothing in its unobstructed light. A canvas tent without a top, in the yard or on the roof or open porch, will serve.

Sun baths, taken regularly, increase the red corpuscles of the blood in great numbers. The supply of calcium, iron and phosphorus in the blood is augmented. Many physical disturbances partially due to sunlight starvation—notably rickets and anemia—can be relieved by daily sun baths. Certain skin diseases can be healed more rapidly when treated by the sun's rays. Sun baths are a valuable tonic for the organs of the body. The ultra-violet rays kill bacteria and germs.

Dr. Sun's best office hours are in the early morning and late afternoon. At mid-day his treatment is more likely to scorch than to heal. Even at the best hours, over-exposure does more harm than good. It is a mistake to try to get tanned too rapidly. Excessive exposure, especially on parts of the body not accustomed to direct rays of the sun, may cause not only painful burns but also serious skin trouble. Exposure should be gradually increased from day to day.

So essential is sunlight to the body that science sought and has found a way to manufacture ultra-violet rays that may be used helpfully in the winter and on days at other times of the year when the sun's rays are weak. But great care should be exercised. Artificial sunlight treatments may be extremely harmful if given by anyone not familiar with their power.

In praising the value of natural sunlight, one eminent physician says, "When we have added together all the healing virtues of the Finsen light and Radium and the Roentgen Rays, and all the uses of heat rays and electrical waves in the care of atrophied or unused muscles—when every particular form of radiation has been tried and exploited to the uttermost—the value of natural sunlight upon us, whether as therapeutic in certain forms of disease, or as hygienic and prophylactic, outweighs all these other things as the Atlantic outweighs the contents of the Olympic swimming pool."

Plan, definitely, to store up health. Get your share of the ultra-violet rays in summer, while they are at their best. A booklet, "Sunlight, the Health-Giver," tells of many benefits to be derived from the sun's rays. It will be mailed free upon request to the Booklet Department, Metropolitan Life Insurance Company, One Madison Avenue, New York City. Send for it.

Haley Fiske, *President.*

METROPOLITAN LIFE INSURANCE COMPANY—NEW YORK

Biggest in the World, More Assets, More Policyholders, More Insurance in force, More new Insurance each year

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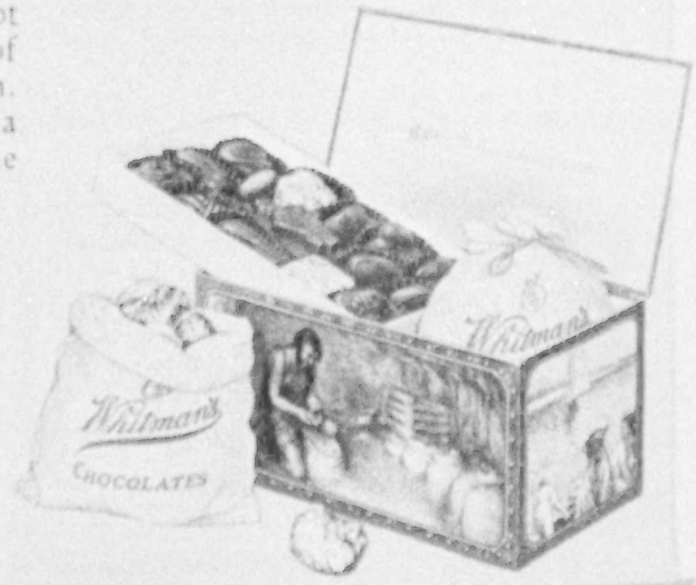
DIVIDING the TREASURE

Eating chocolates is a *social* pleasure. Part of the fun is exploring and dividing the chocolate contents of the PLEASURE ISLAND PACKAGE—real treasures from the Spanish Main. In the chest are a tray and two bags of loot reminiscent of the days of Black Beard and Morgan. Dividing the treasure is a social delight when the chest is

Whitman's

PLEASURE ISLAND CHOCOLATES



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VOL. LIII, No. 6 WASHINGTON JUNE, 1928

THE NATIONAL GEOGRAPHIC MAGAZINE

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SO BIG TEXAS

By Frederick Simpich

Author of "The Great Mississippi Flood of 1927," "Missouri, Mother of the West," "Along Our Side of the Mexican Border," "Singapore, Crossroads of the East," etc., etc., in the National Geographic Magazine

With Illustrations from Photographs by Clifton Adams, Staff Photographer

ONCE upon a time Texas was the butt of much crude humor. "If I owned Texas and Hades," General Sheridan was quoted as saying, "I'd rent Texas and move to the other place." Another ancient gibe, thought funny in its day, affirmed that we should chastise Mexico once more and make her take Texas back again.

But modern Texas—big, fat, bluff and breezy—listens with a smile to tales of her turbulent youth. Power and political experience have taught her tolerance. In her easy-going, slightly Mexican manner, she is too busy working out her own social problems and her huge economic destiny to worry over her past, sensational though it may have been.

A FREE AND INDEPENDENT NATION FOR NINE YEARS

Undeniably, early Texas was turbulent. In a physical sense, also, she was tough. She had to be to conquer, singlehanded, the whole Republic of Mexico when it comprised much of our Southwest and all of California.

Amazing political endurance was also hers. For nine uneasy years she held her own, a free and independent nation. In this period France and England even sent duly accredited representatives to the government of President Sam Houston. Paddling up Buffalo Bayou, wandering overland in oxcarts, these dainty diplomats sought the crude frontier capital. There, donning their plush pants and silver swords, they waded knee-deep in honest Texas mud to the humble "palace" wherein functioned the brawling government of the Lone Star Republic.

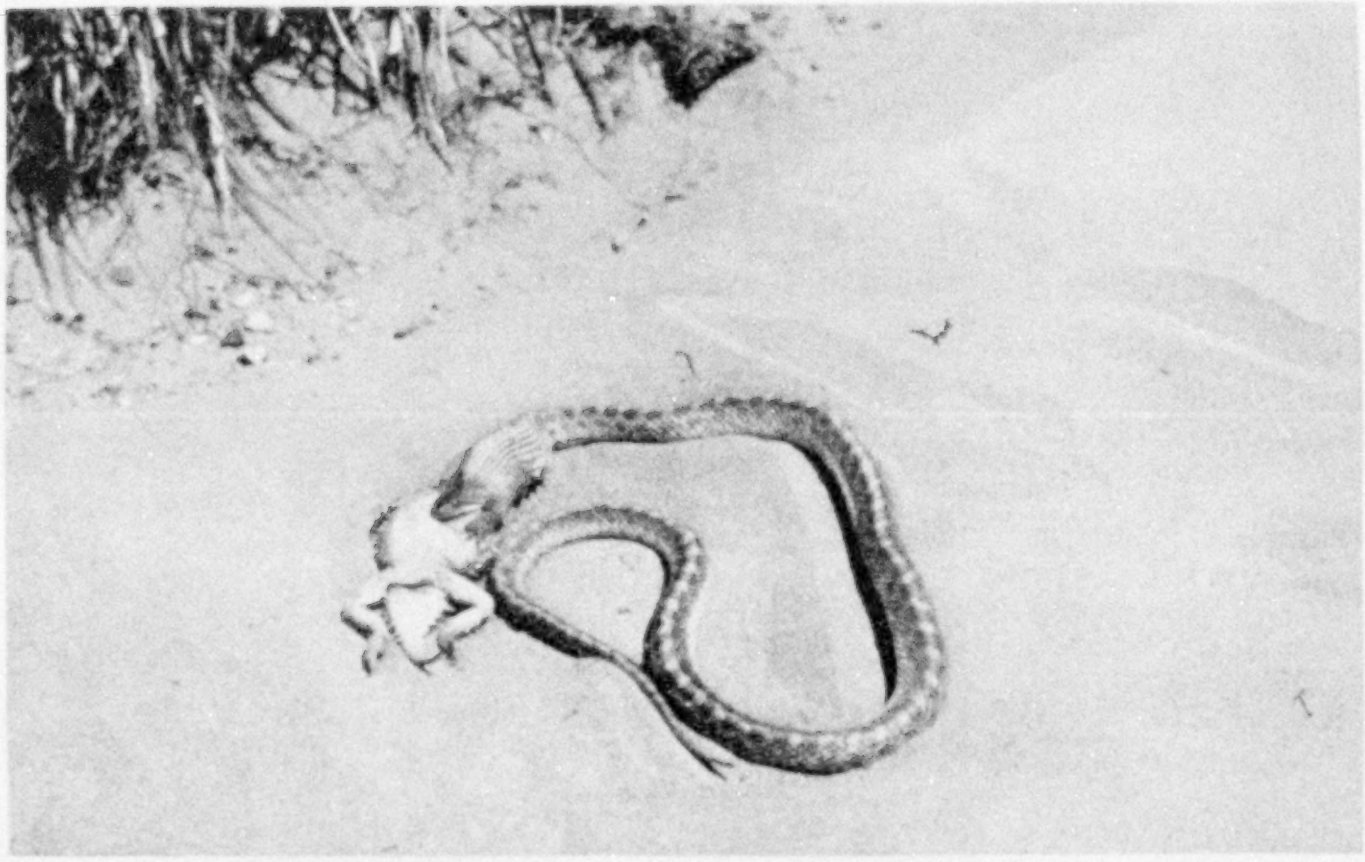
Sam Houston, tradition says, received them, clad likewise in the peacock finery of diplomatic dress, and then excused himself to go outside and stop a quarrel between two of his colleagues.

To-day, in odd contrast, France and England again send agents to Texas. But they are plain-clothes trade emissaries, coming to buy that cotton of which she grows from a fifth to a third of the whole world's supply.

And now, instead of log cabins or adobe huts, there are the sky-piercing "cloud-scratchers" of Dallas (see illustration, page 678), a 1,000-room hotel in Houston, and a market service so perfect that a cablegram about cotton has been sent from Texas to Liverpool and a reply received in three minutes.

As for Buffalo Bayou, now it is a great ship canal, deeply dredged, so that ocean steamers dock at Houston, 50 miles inland, as at another Hamburg (see illustration, page 668).

I repeat, time was when Texas *had* to to be tough, physically speaking. In pre-railroad days it took hardy men to drive 10,000,000 cattle "up the trail" to Kansas and Wyoming, swimming rivers, fighting Indians and blizzards, living for months "on the country." Even now a few of



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A TRAGEDY OF THE REPTILIAN WORLD

Here are all the elements of perfect nightmare. A snake sought to swallow a horned toad. But both died. Mexicans say that when a serpent tries to gulp down a horned toad—or even after he has done so—the toad, by twisting its head and using the spines on its neck as knives, can fatally cut the snake. Both these creatures were dead when discovered by the photographer.

THE FRENCH LEGATION IN AUSTIN WHEN TEXAS WAS A NATION

For nine years Texas was a republic, and received envoys from foreign governments. M. de Saligny, diplomatic representative of France, lived in this modest house, built at Austin in 1840, when he was accredited to the Lone Star Government.

AS FROM THE PAGES OF CERVANTES

A daughter of Cortez may listen to the lilting love song "Muñequita," sung by the *charro*, or gentleman cowboy, in tight trousers and bright serape. A garden scene in old "San Antone," where the atmosphere of Spain is still to be found.

Photograph Courtesy First National Pictures

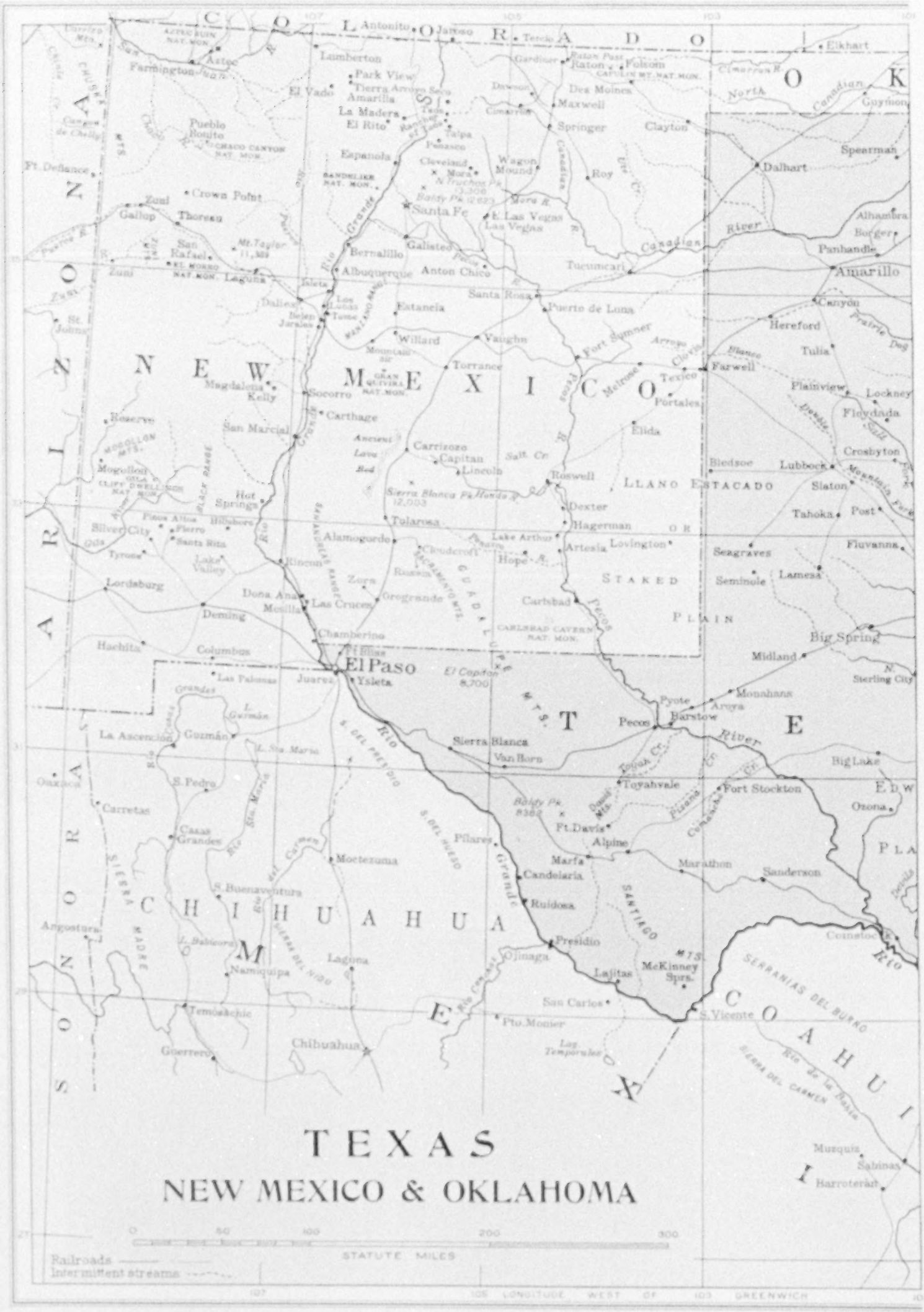
IN OLD BARBED-WIRELESS DAYS COUNTLESS CATTLE PLODDED UP THE TEXAS TRAIL

As late as 1905 about 10,000,000 cattle ranged the Texas plains. Now the bawling, snorting, dirt-pawing longhorn that ran with the wild mustangs—a gaunt, high-speed bovine, hard to fatten—has passed away. In his place has come the straight-backed, white-faced Hereford—tamer, easier to fatten, and heavier in meat (see "The Taurine World," by Alvin Howard Sanders, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1925).

© J. F. Gandara

TEXAS CATTLE ON A MEXICO RANGE

Nature designed Mexico as the great cow pasture of North America. Infinite misty blue miles of rolling, grassy plains on the great tableland of Mexico are ideal for cattle grazing, but years of revolution have thinned the herds. At times Mexico has actually had to buy cattle from Texas, and lately Texas ranchers have sent many herds to graze on the fine pastures of Chihuahua.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Jarosa
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Gardiner
Raton
Folsom
Elkhart
Clayton
Springer
Maxwell
Des Moines
Dawson
Cimarron
Guymon
Spearman
Dalhart
Alhambra
Borger
Panhandle
Amarillo
Canyon
Hereford
Tulia
Farwell
Plainview
Lockney
Floydada
Crosbyton
Lubbock
Slaton
Tahoka
Post
Fluvanna
Seagraves
Seminole
Lamesa
Big Spring
Midland
Sterling City
Monahans
Pyote
Arroya
Barstow
Pecos
Big Lake
Toyahvale
Fort Stockton
Ozona
Marathon
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Juarez
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Columbus
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Lordsburg
Hachita
Las Cruces
Mesilla
Dona Ana
Chamberino
Carlsbad
Carlsbad Caverns Nat. Mon.
Artesia
Lovington
Hope
Lake Arthur
Hagerman
Dexter
Roswell
Elida
Portales
Texico
Melrose
Fort Sumner
Vaughn
Willard
Estancia
Santa Rosa
Puerto de Luna
Tucumcari
Anton Chico
Las Vegas
Santa Fe
Galisteo
Bernalillo
Albuquerque
Los Lunas
Belen
Jarales
Tome
Dalies
Isleta
Laguna
El Morro Nat. Mon.
San Rafael
Grants
Zuni
Gallup
Thoreau
Crown Point
Ft. Defiance
Pueblo Bonito
Chaco Canyon Nat. Mon.
Aztec Ruin Nat. Mon.
Farmington
Aztec
Lumberton
Park View
Tierra Amarilla
El Vado
La Madera
El Rito
Tres Piedras
Taos
Ranchos de Taos
Talpa
Penasco
Espanola
Cleveland
Mora
Wagon Mound
Roy
Gallinas
Canadian
Conchas
Pecos
Rio Grande
Jemez
Rio Puerco
Chama
Rio Chama
Gallinas Mts.
Sandia Mts.
Manzano Mts.
Mt. Taylor 11,389
Zuni Mts.
Datil Mts.
Magdalena Mts.
Gallinas Mts.
Sacramento Mts.
Guadalupe Mts.
Organ Mts.
Franklin Mts.
Hueco Mts.
Davis Mts.
Chisos Mts.
Glass Mts.
Del Norte Mts.
Sierra Madre
Sierra del Nido
Sierra del Carmen
Serranias del Burro
Sierra del Mulato
Sierra del Huerfano
Sierra Blanca Pk. 12,003
Capitan
Lincoln
Carrizozo
Ancient Lava Bed
Salt Cr.
Torrance
Mountainair
Gran Quivira Nat. Mon.
Socorro
Kelly
Magdalena
Carthage
San Marcial
Rincon
Hot Springs
Las Palomas
Silver City
Pinos Altos
Hillsboro
Fierro
Santa Rita
Tyrone
Lake Valley
Mogollon
Mogollon Mts.
Gila Cliff Dwellings Nat. Mon.
Reserve
Black Range
Alamogordo
Tularosa
Cloudcroft
Zuni
Zorro
Gregrande
Guzman
La Ascencion
S. Pedro
Carretas
Casas Grandes
Moctezuma
S. Buenaventura
Namiquipa
Lagona
Temosachic
Chihuahua
Guerrero
Pto. Monier
San Carlos
Lag. Temporales
Sierra Blanca Pk. 8382
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Toyah Cr.
Pecos River
Big Lake
Coahuila
Chihuahua
Nuevo Leon
Texas
New Mexico & Oklahoma
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Statute Miles
Railroads
Intermittent streams
105 Longitude West of 103 Greenwich

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ARKANSAS
LOUISIANA
TEXAS
MEXICO
GULF OF MEXICO
Englewood
Kiowa
Arkansas City
Ponca City
Bartlesville
Pawhuska
Miami
Picher
Neosho
Buffalo
Beaver
Blackwell
Enid
Alva
Medford
Tonkawa
Cherokee
Newkirk
Arkansas R.
Billings
Nowata
Vinita
Chelsea
Claremore
Pryor
Grand R.
Neosho R.
Eureka Springs
Berryville
Harrison
Rogers
Springdale
Fayetteville
Lipscomb
Shattuck
Woodward
Fairview
Okeene
Canadian
Watonga
Kingfisher
Cimarron R.
North Canadian R.
Guthrie
Cushing
Stillwater
Yale
Perry
Tulsa
Broken Arrow
Sapulpa
Bristow
Muskogee
Tahlequah
Pt. Gibson
Sallisaw
Van Buren
Fort Smith
Greenwood
Huntington
Hartford
Booneville
Dardanelle
Russellville
Atkins
Morrilton
Arkansas R.
BOSTON MTS.
Leslie
Oklahoma City
Edmond
El Reno
Chickasha
Shawnee
Norman
Holdenville
Canadian R.
Deep Fork of Canadian R.
Okemah
Henryetta
Checotah
Okmulgee
Sallisaw
Stigler
Poteau
Alma
Waldron
Mena
Hot Springs
Little Rock
OUACHITA MTS.
Elk City
Clinton
Cheyenne
Weatherford
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Sayre
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Duncan
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Ringling
Wilson
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Wynnewood
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Atoka
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Krebs
Haileyville
Hartshorne
Wilburton
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Prescott
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Thornton
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Idabel
Foreman
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Hope
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Texarkana
McNeil
Magnolia
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Stampede
Wichita Falls
Iowa Park
Electra
Crowell
Matador
Paducah
Roaring Springs
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Red R.
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Mc Kinney
Decatur
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Greenville
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Atlanta
Pittsburg
Caddo Lake
Vivian
Homer
Minden
Rockwall
Winnsboro
Alba
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Mineola
Gilmer
Jefferson
Marshall
Longview
Hooper
Mar Grove
Arcadia
Shreveport
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Dallas
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Kaufman
Forney
Perry
Waxahachie
Tyler
Overton
Henderson
Carthage
Center
Timpson
Nacogdoches
Natchitoches
Zwolle
Coushatta
Mansfield
Hamlin
Stamford
Rotan
Roby
Anson
Albany
Breckenridge
Strawn
Abilene
Snyder
Colorado R.
Clear Fk.
Merkel
Sweetwater
Roscoe
Baird
Moran
Thurber
Ranger
Eastland
Cisco
Desdemona
Tuscola
Gorman
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De Leon
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Clifton
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Brownwood
Coleman
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Miles
Sta. Anna
Winters
Colorado R.
Concho R.
San Angelo
Paint Rock
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Eden
Brady
San Saba
Lampasas
Goldthwaite
Waco
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Moody
Temple
Killeen
Belton
Florence
Rogers
Bartlett
Granger
Taylor
Georgetown
Liano
Llano River
Menard
Sonora
Fredericksburg
Austin
Elgin
Bastrop
Smithville
Lockhart
Luling
Gonzales
Seguin
Guadalupe River
San Marcos
Kerrville
Boerne
New Braunfels
Camp Wood
Ft. Clark Springs
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Uvalde
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Bryan
Navasota
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Cleveland
Houston
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Waller
Sour Lake
Beaumont
Port Arthur
Orange
Grayburg
Spindletop Oil Field
Lake Sabine
Sabine
Goose Creek
Galveston Bay
Sabine R.
Sabine Lake
Vinton
Calcasieu
Lake Charles
De Quincy
Jennings
Kirbyville
Merryville
Newton
De Ridder
Leesville
Fullerton
Wiergate
White City
Crockett
Lufkin
Hemphill
San Augustine
Nacogdoches
Groveton
Trinity
Madisonville
Huntsville
Livingston
Trinity River
Neches River
Sabine River
Hearne
Calvert
Franklin
Mexia
Groesbeck
Mart
Oakwood
Jewett
Marlin
Waco
Hubbard
Wortham
Palestine
Jacksonville
Rusk
Alto
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Tyler
Athens
Ennis
Corsicana
Italy
Itasca
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Stephenville
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San Marcos R.
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Medina R.
Frio R.
Nueces R.
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Aransas R.
Aransas Pass
Rockport
Corpus Christi
Corpus Christi Bay
Mustang Island
Padre Island
Laguna Madre
Matagorda Island
San Antonio Bay
Espiritu Santo Bay
Port Lavaca
Victoria
Goliad
Beeville
Skidmore
Kenedy
Karnes
Christine
Pearsall
Eagle Pass
Crystal City
Carrizo Springs
Zaragoza
Piedras Negras
Allende
Guerrero
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Catarina
Cotulla
Tilden
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Hidalgo
Darwin
Colombia
Nuevo Laredo
Laredo
Jarita
Rio Grande
Rio Grande R.
Alice
San Diego
Kingsville
Riebbronville
Falfurrias
Raymondville
San Ygnacio
Zapata
NUEVO LEON
TAMAULIPAS
Harlingen
San Benito
Brownsville
Rio Grande
Monte Cristo
Edinburg
Mission
McAllen
Weslaco
Donna
Progreso
Los Indios
Santa Rosa
Port Isabel
Laguna Madre
Arroyo Colorado
Resaca de la Palma
Resaca de los Rucios
Resaca de los Cuates
Resaca de los Fresnos
Resaca de los Cuates
Resaca de los Rucios
Resaca de la Palma

© J. F. Gandara

CRUISING THROUGH COTTON ON THE AFTERDECK OF A BURRO

Without her numerous Mexican population, Texas could not pick her cotton, irrigate her fields, build her roads, or work her sheep and cattle. Because Texas-born Mexicans—sometimes known locally as "Tex-Mex"—are officially listed merely as whites, no one knows just how many of that race live here.

Photograph from Frederick Simpich

FAT, LAZY MULES DEEP IN PECOS COUNTY ALFALFA

From New Mexico across west Texas to the Rio Grande runs the Pecos River valley, a garden spot of singular beauty. The cross-country motorist, his eyes strained and weary from the bright glare of monotonous desert miles, hails with relief the sight of these restful green fields and rustling cottonwoods. Recently an oil field has been developed here.

Official Photograph, U. S. Army Air Corps

"THE DUSTIEST RIVER IN THE WORLD" FLOWS BETWEEN TEXAS AND MEXICO FOR MORE THAN NINE HUNDRED MILES

Through long years of surveys, mappings, and bilingual debate, the Mexican-American Boundary Commission has followed the floods and meanderings of this restless river. Without moving their homes, dwellers along its course have found themselves first in Mexico, then in Texas, then back again, as the channel shifted. In the left foreground is busy El Paso, entrepôt for central Mexico. Across the Rio Grande (upper right) is the bullfighting, casino-loving Mexican city of Juárez, mecca for endless streams of American tourists, who have only to cross a bridge. "Go abroad for six cents" reads the "ad" of an El Paso street-car line. Near the center of Juárez appears a large circle—the bull ring.

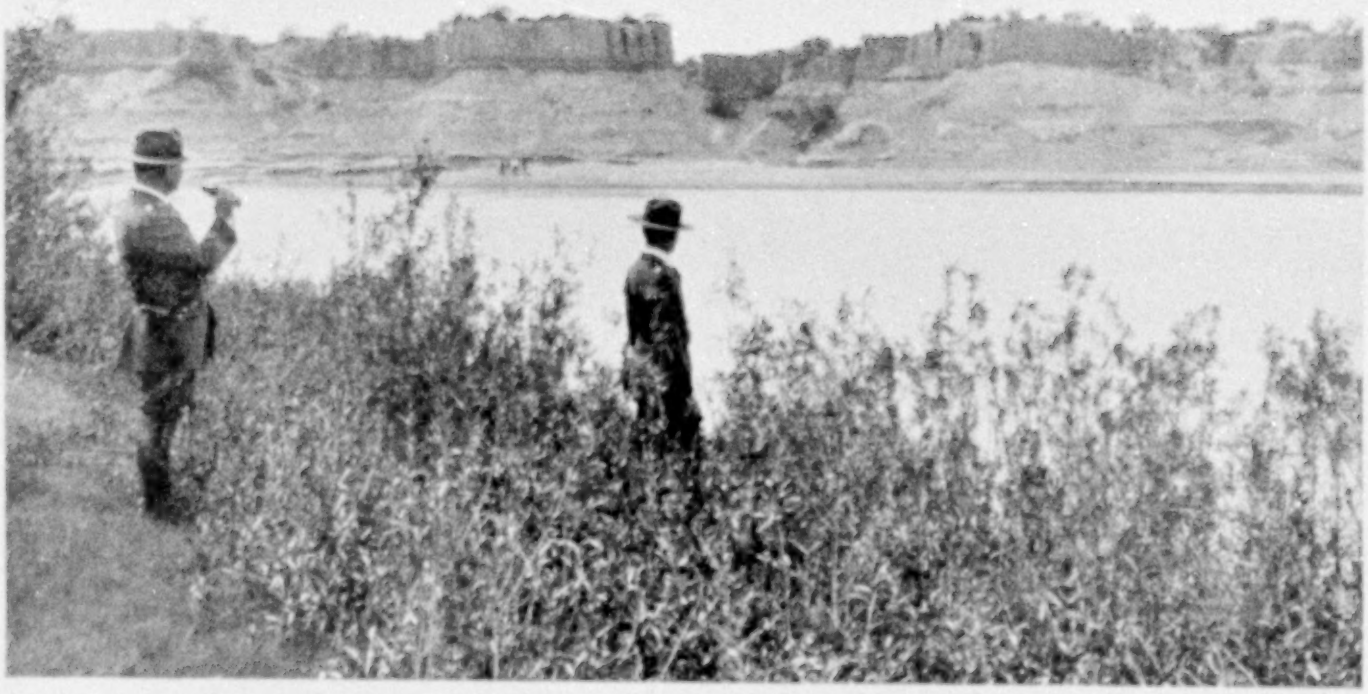
these arrow-punctured, bullet-creased old trail riders survive, reminiscently wiggling rheumatic trigger fingers as they tell their little grandsons stirring tales of adventure in old days, "when there wasn't a wire fence in all Texas."

THE TEXAS OF SONG AND STORY HAS PASSED INTO HISTORY

There was, of course, no sudden, overnight change in the daily life of Texas. Her social, moral, and economic transition covered decades. Yet it is a curious sociological fact that Texas had begun to put her house in order long before many Eastern States responded to similar twinges of conscience. Texas "went dry" in big spots before the national prohibition law was passed. Long years ago she closed her last gambling house. As early as 1883 the Texas Cattlemen's Association adopted a by-law forbidding cowboys to

TEXAS NYMPHS IN PLASTIC POSES

Because half its area is semi-arid, Texas, a farm State, has many water problems. For all uses, it spends $45,000,000 a year on water. From this Catarina bathing pool water is used later for irrigation.



SMUGGLING IS A LIVELY TRADE ALONG THE RIO GRANDE

Drugs, liquors, and aliens all reach the United States illicitly across this shallow stream. These two officers of the American Border Patrol are on the lookout at Smugglers' Bend, near Laredo. Shooting affrays between the patrol and smugglers occur frequently along the border.

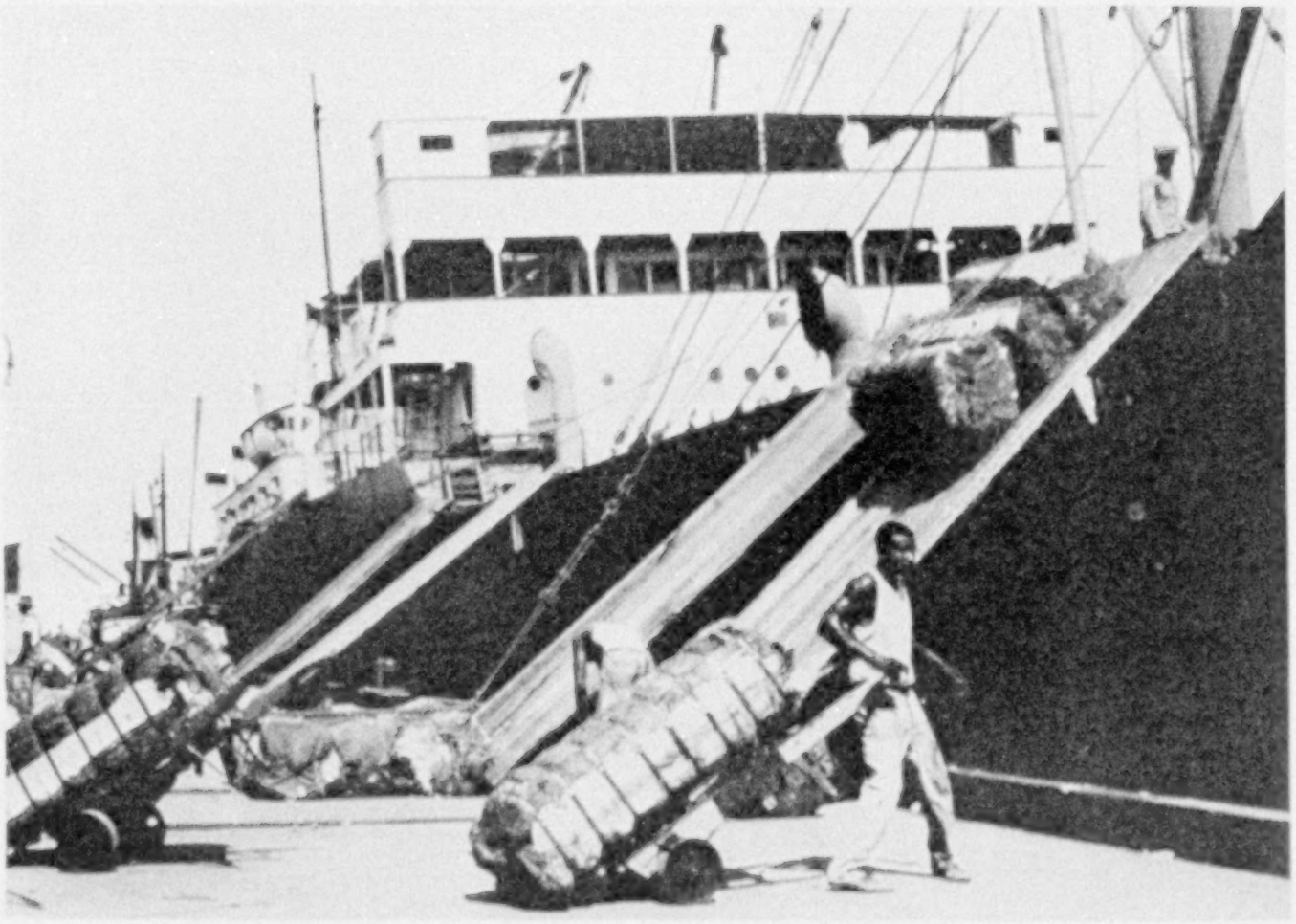
Photograph by Duncan

GIVE HIM HIS HEAD AND IT'S ASTONISHING WHERE A HORSE CAN GO

"Letting 'em take it easy," United States cavalrymen descend a steep trail in Presidio County, near the Rio Grande. Dust, squeaking leather, and the tonic smell of horses sweating on hot days—these are memories in old troopers' souls.

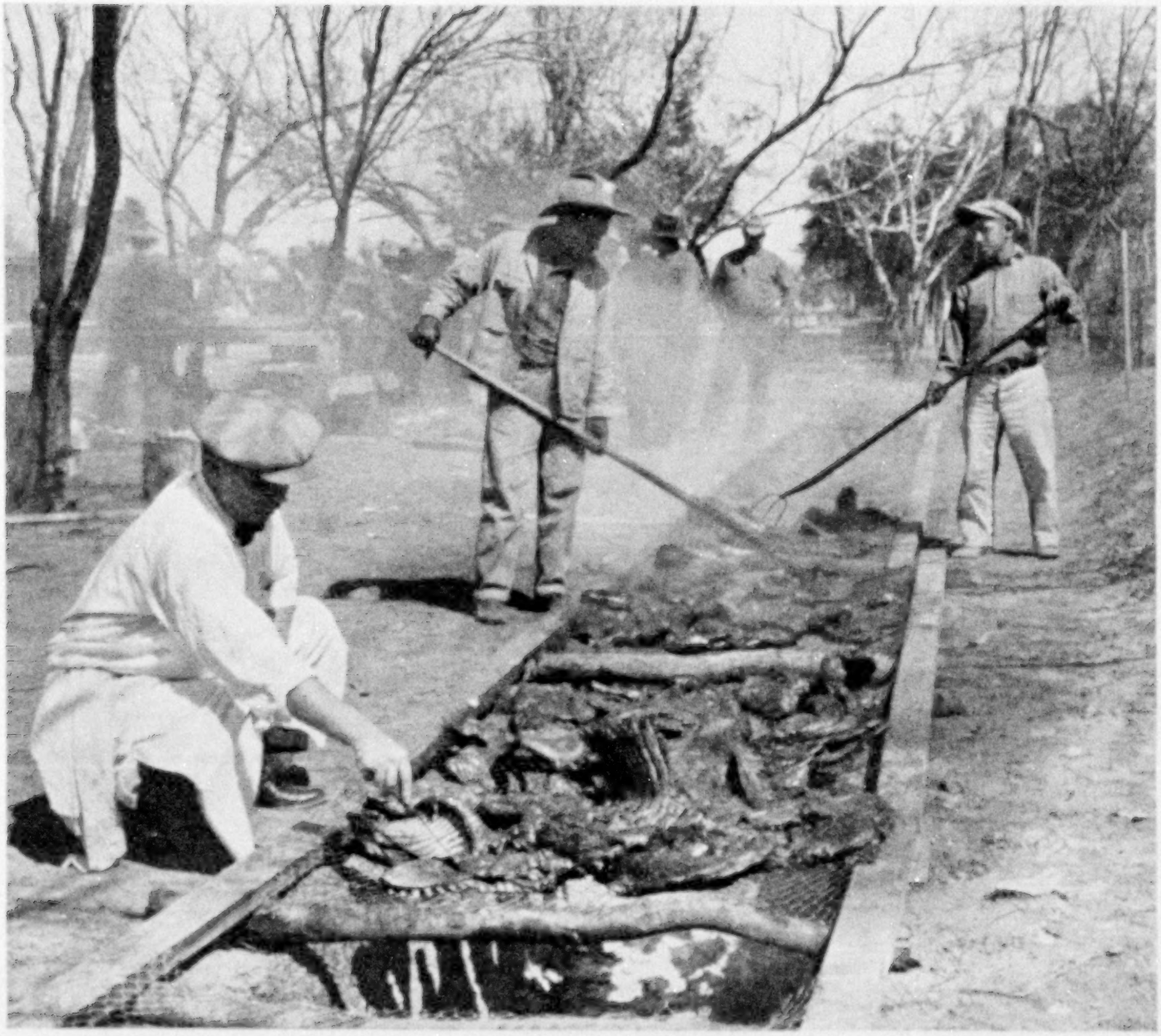
Photograph by J. F. Gandara

RECALLING DORÉ'S DRAWINGS FOR DANTE'S INFERNO: TWISTED YUCCAS SPRAWL ON SCORCHING SANDS



LOADING COTTON AT CORPUS CHRISTI, LATEST ADDITION TO THE DEEP-WATER PORTS OF TEXAS

Recent completion of a channel through Corpus Christi Bay makes this port, long popular as a fishing and pleasure resort, easily accessible to large steamers. It also lies on the line of the long Intracoastal Canal, which, when finished, will extend from New Orleans to the mouth of the Rio Grande.



AN OLD-FASHIONED COUNTRY BARBECUE

Beef is being roasted over a pit to regale a picnic party of Texas bankers, near Progreso, on the Rio Grande.

"race horses or fire off pistols indiscriminately around the herds." To-day, playing cards on a Texas train even "for fun" is against the law.

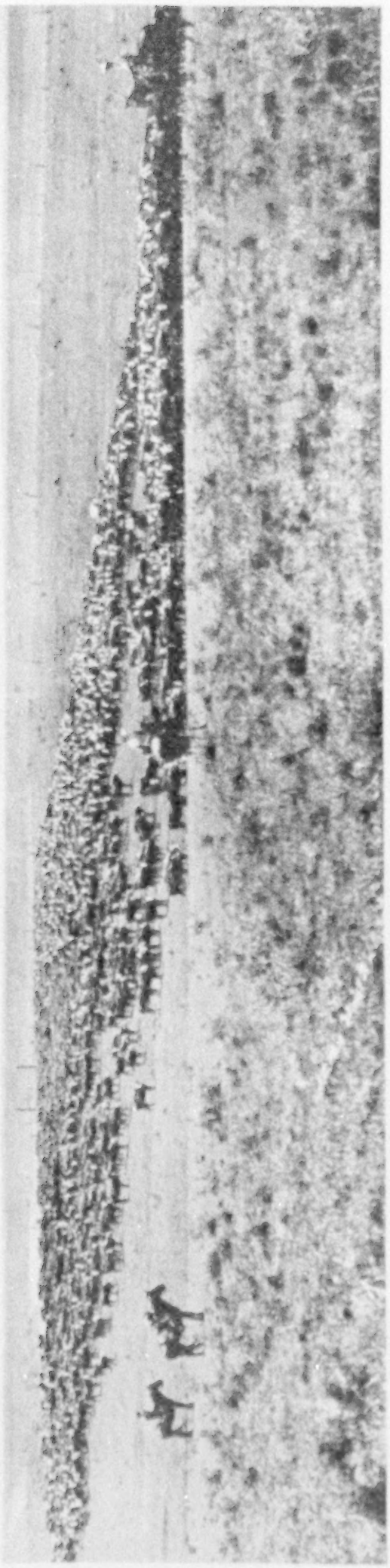
The dust of the plains on the shoes and a big hat are still badges of old-established social position, hinting at kinship with cattle kings. But, except in politics, the tumult and shouting of early days are dead.

TEXAS IS TRUE TO HER HEROES

Remembering the Alamo is still a popular patriotic pastime. The Alamo and the bigness of Texas are among the first things taught to Texas children. She is true to her heroes. Austin, Nolan, Travis, Davy Crockett, Houston, Bowie, and all the bizarre, romantic figures, the adventurers and swashbucklers whose daring deeds gave vivid color to her history and helped make her a great State, are to Texas what William Tell is to the Swiss or Garibaldi to the Italians.

Though Mexicans are no longer "the chief pursuit of Texas," from the Mexican War down to this minute, the State has had her troubles with Mexicans. At present her trouble is to get enough Mexicans to pick her cotton, work her oil fields, mills, and railway shops, shear goats and sheep, and to gather the long trainloads of fresh vegetables and fruits shipped annually from the lower Rio Grande.

By lawful entry through border immigrant offices and by illegal entry over many a lonely *bosque* trail, tens of thousands of Mexicans march north into Texas every year. Whole areas of the State are



Photograph by Gray

NEARLY 16,000,000 HEAD OF LIVESTOCK LIVE ON TEXAS FARMS AND RANCHES

Trail driving from Texas up to Kansas and beyond continued till about 1885, by which time the expansion of railway service to the north enabled the annual beef crop to be shipped out by train. Later, packing houses were erected in the State. Now a large amount of Texas beef is packed at home.

tinted a rich Aztec brown. El Paso has more than 100,000 inhabitants, half of whom are Mexicans. Farther down the Rio Grande, "dustiest river in the world," often the percentage of Mexicans is even greater.

As in New Mexico, so here in Texas, Mexicans have entered largely into the economic life of the country and, to some extent, into local politics. From the Texas border, also, they have spread as far north as the beet fields of Colorado, the railroad shops of Chicago and Pittsburgh, and even to the fisheries of Alaska.

Here in Texas very often the Mexican immigrant is the chief source of unskilled labor. And it takes a veritable army to do the work of the State, even the railway and shipping work. A million and a half cars of freight, mostly farm products, originated in Texas last year, and her roads hauled, all told, close to 3,500,000 cars of freight across the State.

Galveston, known still to millions of Americans merely as a town that once suffered a frightful tidal wave, is now one of the leading seaports in the whole United States (see pages 667 and 678). Oil pipe lines run down to it and to Houston from as far away as Wyoming!

ENDLESS DELIGHT FOR THE STATISTICIAN

Texas *is* so big! So big, some one said, that the people of El Paso jeer at those of Galveston as being effete easterners. In terms of people, area, animals, crops, and natural wealth she is so big and her regional interests are so diverse that she has outgrown her very constitution, as a boy outgrows his pants. Laws good for east Texas may be bad for west Texas. State policies agreeable to the natives on the lower Rio Grande may cause

© J. F. Gandara

IN THE OLD DAYS, WHEN TEXAS HAD MORE TIME AND LESS GOODS, THESE CARTS WERE USED

Another type of early-day cart had solid wheels made from cross-sections of logs. When heavily loaded and not well greased, these vehicles whine and howl like hyenas. Though they have almost vanished, a few may still be seen along the lower Rio Grande, usually on the Mexican side.

© Albert Friedrich

SUCH HORNS WENT OUT OF STYLE WHEN CATTLE CAME TO RIDE IN CARS

The Texas Longhorn, wearer of such wide-spreading decorations, has disappeared from western ranges.

grief and pain to those hundreds of miles away in the vast Panhandle.

Here in this big Texas that peculiar type of sport-loving near-statistician, who revels recklessly in fantastic figures, finds himself in clover. He has so many millions of everything to add up and make tables about!

MUNCHAUSEN TALES CONFOUND THE NEWCOMER

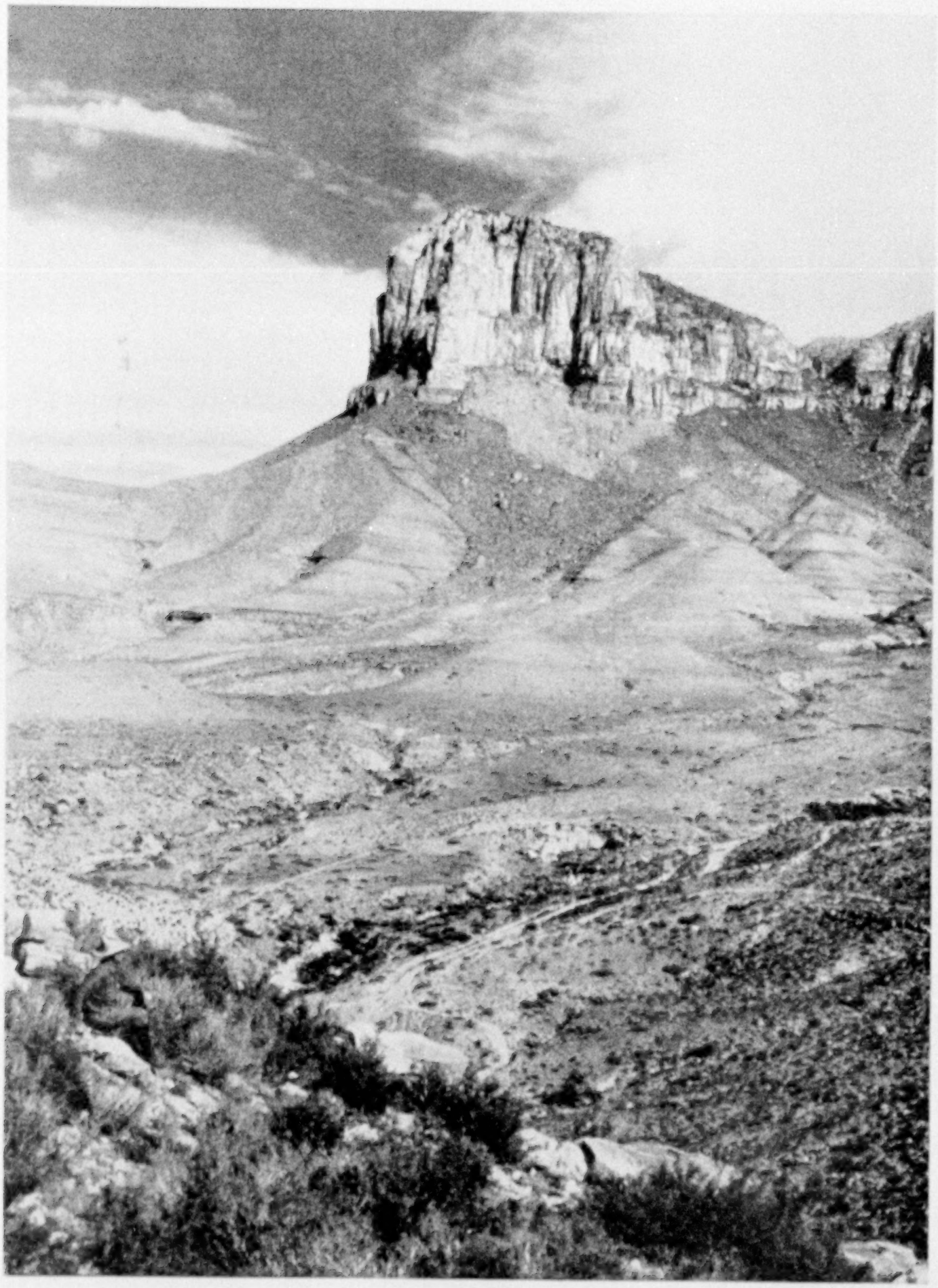
Merely to confound the newcomer, the native himself takes delight in repeating Munchausen tales of Texas; or in mentioning casually, for example, that it's farther from El Paso to Beaumont than it is from New York to Chicago. Were Texas as densely settled as Massachusetts, she'd have more than 131,000,000 people.

To population experts, the capacity of Texas for supporting many more people is no new theme. But the map alone is misleading. Many high, dry regions of west Texas will probably remain empty or but scantily peopled for a long, long time. Yet, disregarding these unfriendly areas, no other State holds greater potentiality for future increase in population. And, though not widely advertised, there are winter playground regions in Texas as charming and salubrious as any in America.

That Texas will, in our time, become the objective of a great mass movement of people, as California and Florida have been, seems now unlikely. Texans themselves do not expect it. Yet no one dreamed a few years ago that Florida would so soon see such tremendous immigration. Large movements of people from one map spot to another are social phenomena peculiar to America. Unlike Europeans, we seldom spend our lives where we were born.

When I was a boy in the Middle West, tens of thousands of prosperous farmers, apparently contented, sold out; with money that totaled millions they moved to western Canada. Later, many moved back. At another time many mid-western counties actually lost population when farmers swarmed for the Indian Territory. The human tide to Texas, so far, has been steady, but never in any sense a great migration.

When Stephen F. Austin founded his famous colony on the banks of the Brazos,



Photograph by Jacob Gayer

SUBLIME AND ALONE, ABOVE AN EMPTY, SILENT WORLD

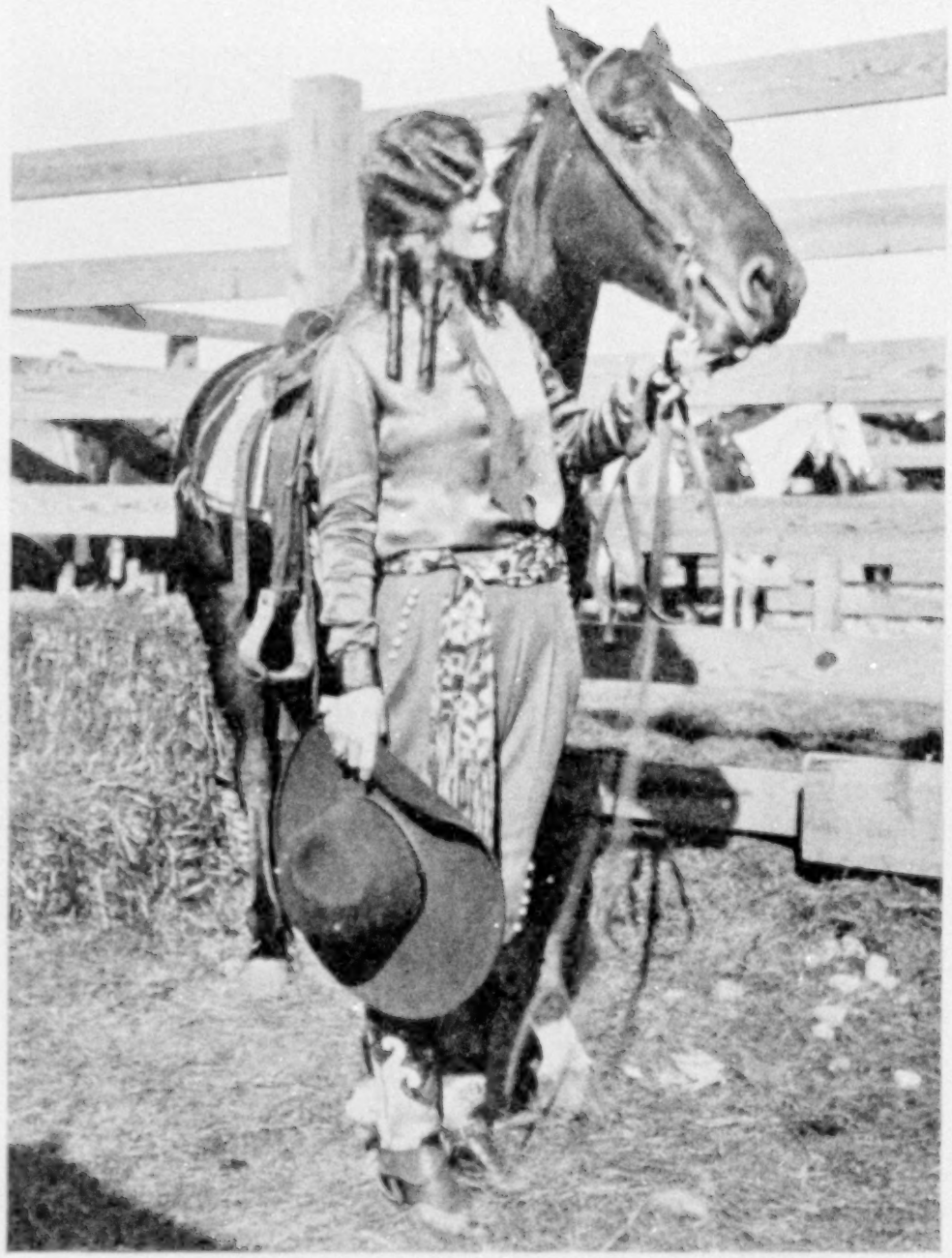
Dry and dead, like burnt-out craters on the moon, certain areas in west Texas are absolutely uninhabited and always will be, even until Judgment Day; for there is no water. From atop this bold Guadalupe peak, northeast of El Paso, one may gaze across miles of desert wilderness.

SEEING SNAKES IN A SAFE, SANE WAY

Man may crush the serpent with his heel, but he saves the hide. Tanned snake skin, sold to the trade at 40 or 50 cents a running foot, is used to make belts, hatbands, purses, and shoes. An "animal farm" near Brownsville, Texas, buys many of its "diamond back" rattlers from Mexico, and also markets snake oil, rattles, and venom.

MISS TEXAS TIPS HER HAT

In the popular mind, Texans wear big ten-gallon cowboy hats, "with rims so wide that swallows build mud nests under them, mistaking them for the eaves of a barn." But these light hats, made at Brownsville (see, also, page 661), are much worn along the lower Rio Grande and on the hot coast.

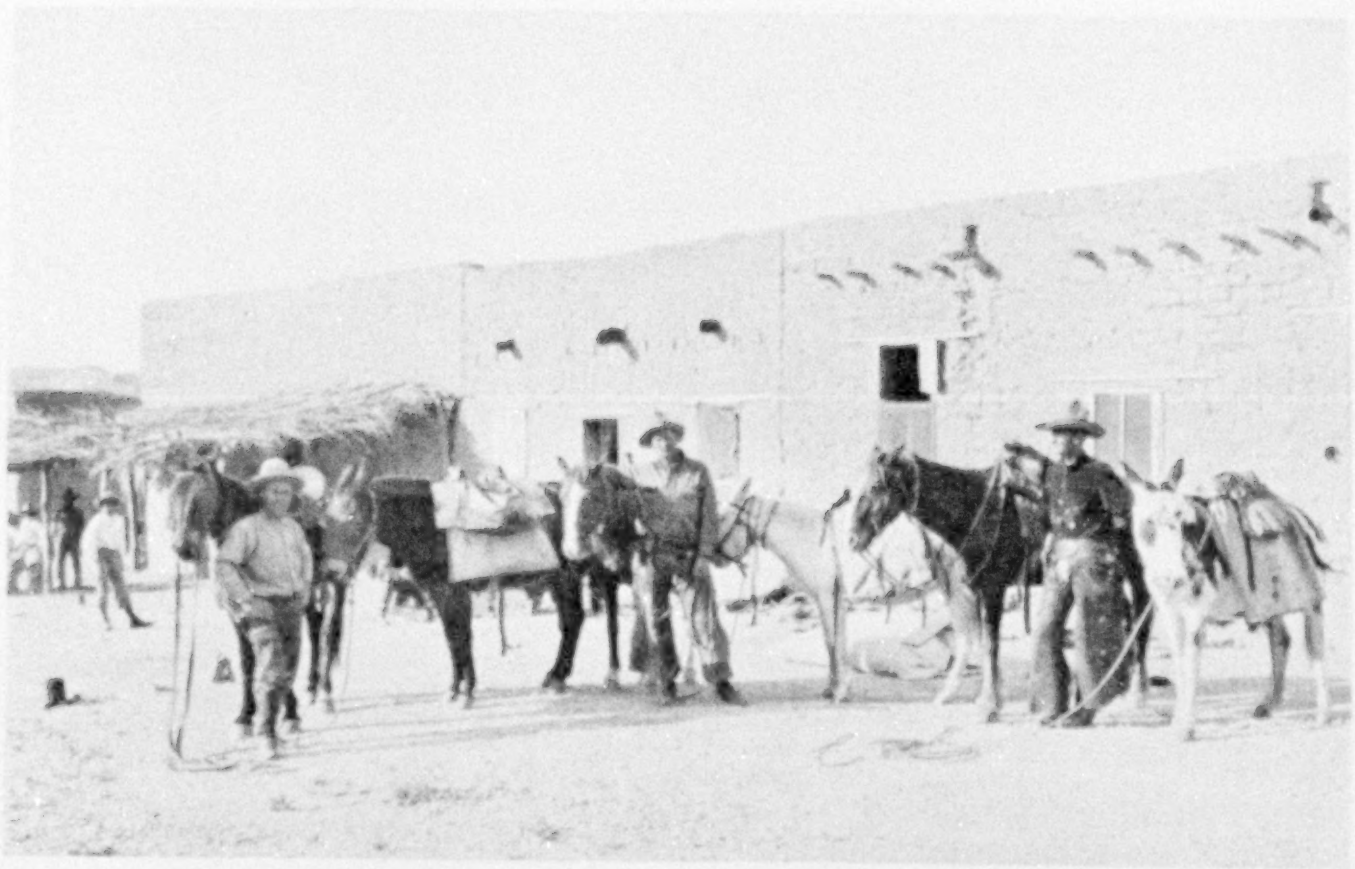


SHE EARNED HER SPURS

Despite her Wild Bill curls and Dick Turpin air, this trick rider of the rodeo ring is more than a professional cowgirl follower of Wild West shows. She got her training in the hard school of range routine, helping her father punch his own cattle.

HE COULD RIDE ALMOST BEFORE HE LEARNED TO WALK!

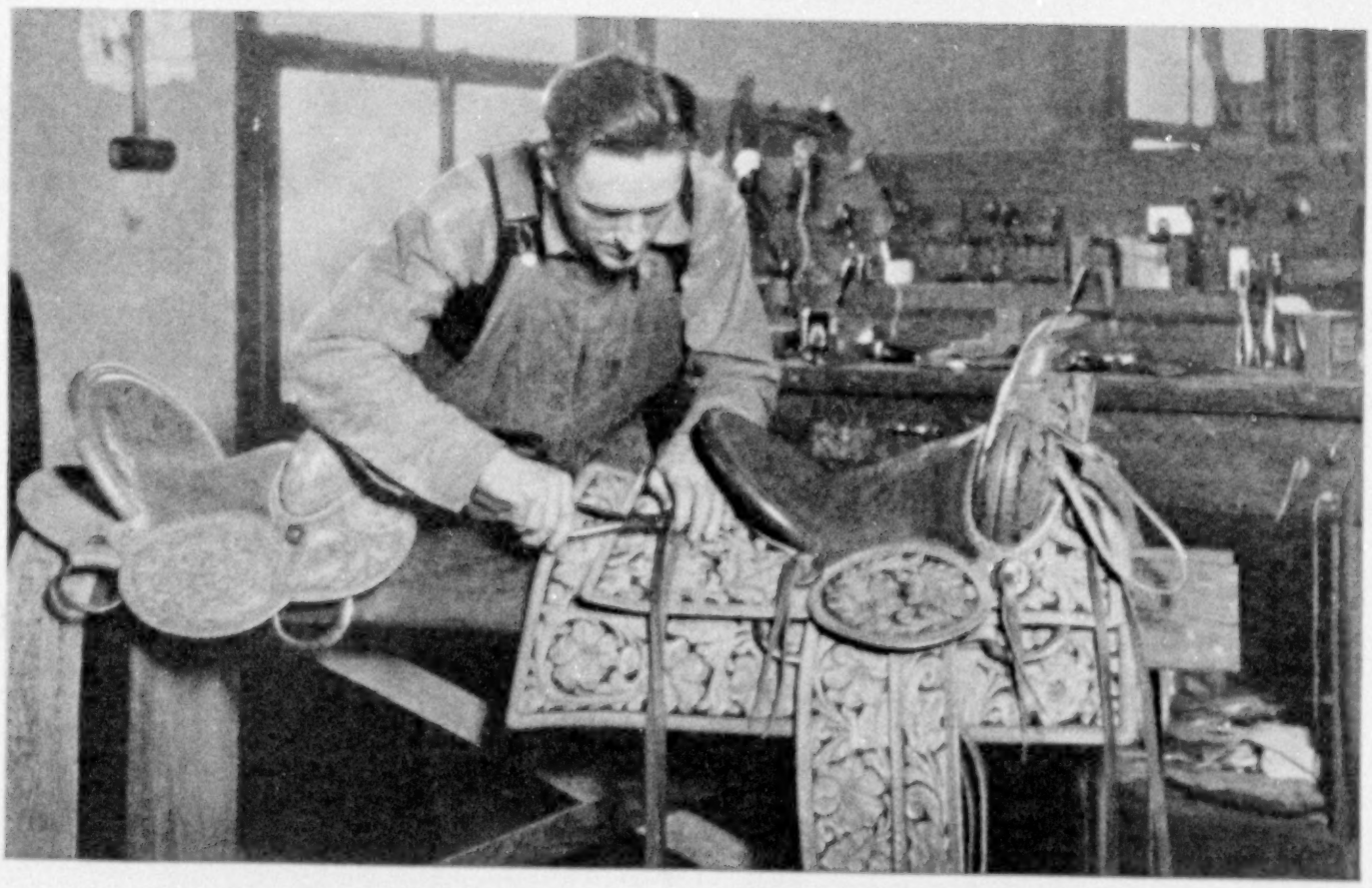
"Hello, horse, where are you going with that boy?" is an old West gibe at juvenile riders. This potential recruit for cowboy movies was photographed at a Texas livestock show. From all over the cow country, men and their wives attend these fairs each spring to bid, to buy, and to sell.



Photograph by Duncan

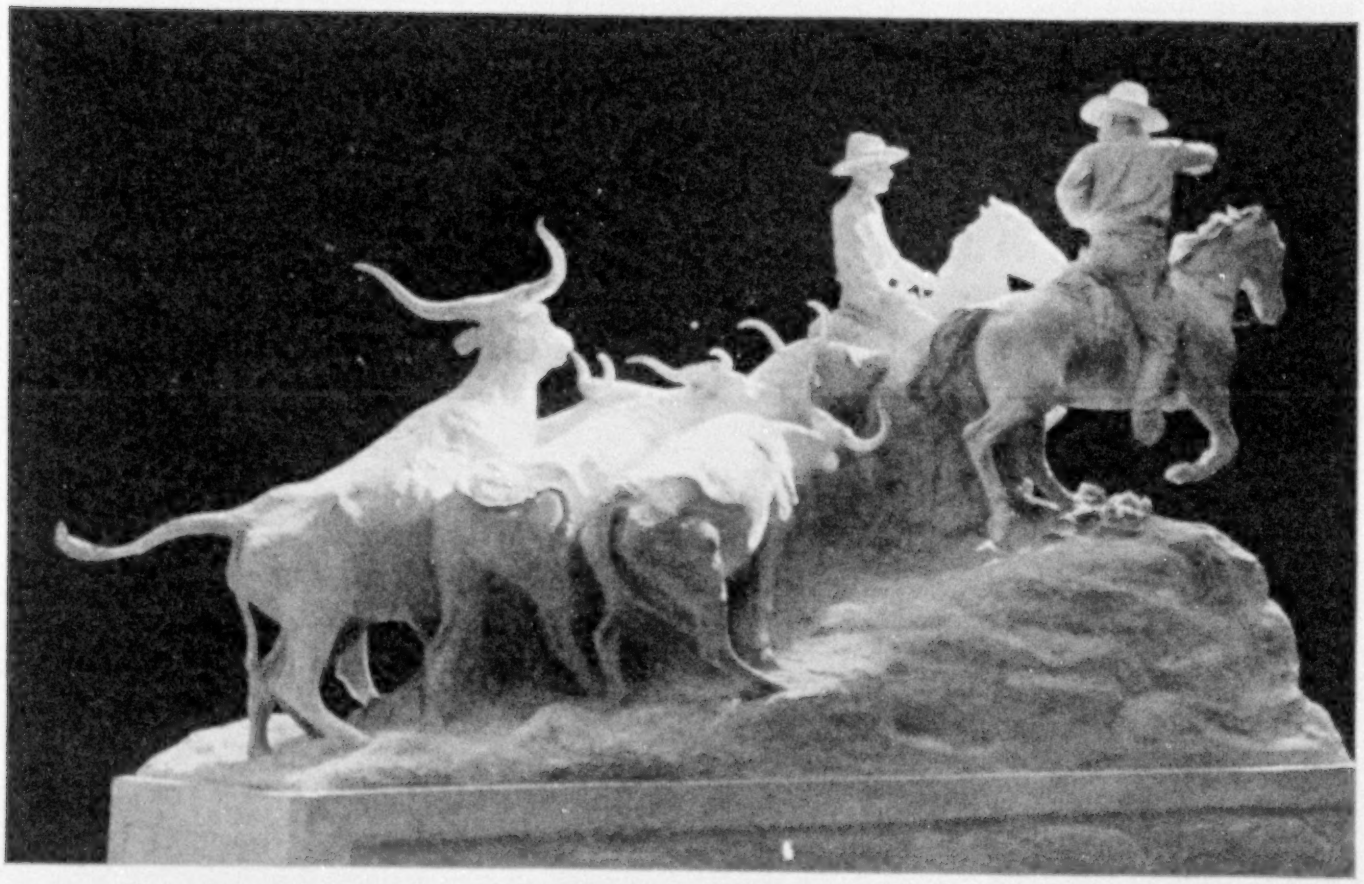
AN AUTHENTIC BIT OF THE OLD, UNSPOILED WEST

There's naught of the dude ranch or moving-picture make-up in this businesslike tableau. Here are *bona fide* cowmen, with saddle horses and pack mules, in the working clothes of their hard calling. The day's ride done, they boil coffee, then roll into blankets wherever night falls.



SINCE MAN FIRST RODE, HE HAS STUDIED AND PERFECTED HIS SADDLE

To the varied and strenuous needs of the cow rancher, whether riding herd, cutting, roping and throwing for branding, or breaking young horses to ride, the stout, heavy Texas saddle is singularly well adapted. With his rope coiled in front, coat and blanket tied behind his saddle, and perhaps a canteen and bit of cold grub, the cowboy is all set for a long ride. At Fort Worth, mecca for cowmen in quest of equipment, such a saddle sells for $125.



Photograph from Frederick Simpich

HOOFS, HORNS, AND TAILS

Beef first made Texas rich. After the Civil War, millions of cattle were driven "up trail" to better range and to market. Transcontinental railroad builders consumed trainloads. A model of the Old Trail Drivers' monument, by Gutzon Borglum, for San Antonio.

HIGH-HEELED, FANCY-TOPPED BOOTS ARE THE COWBOY'S PRIDE

In his hard, rough life, remote from barbers, bathtubs, and haberdashers, the cowboy tickles his vanity with silver-mounted saddle, bridles, fancy spurs, and handmade boots that cost a month's pay. This Texas-made cowman's boot is world-famous. One Fort Worth family which sells its wares as far away as Australia and Argentina has been manufacturing cowboy footwear for nearly half a century.

TEXAS SHRINE: THE ALAMO!

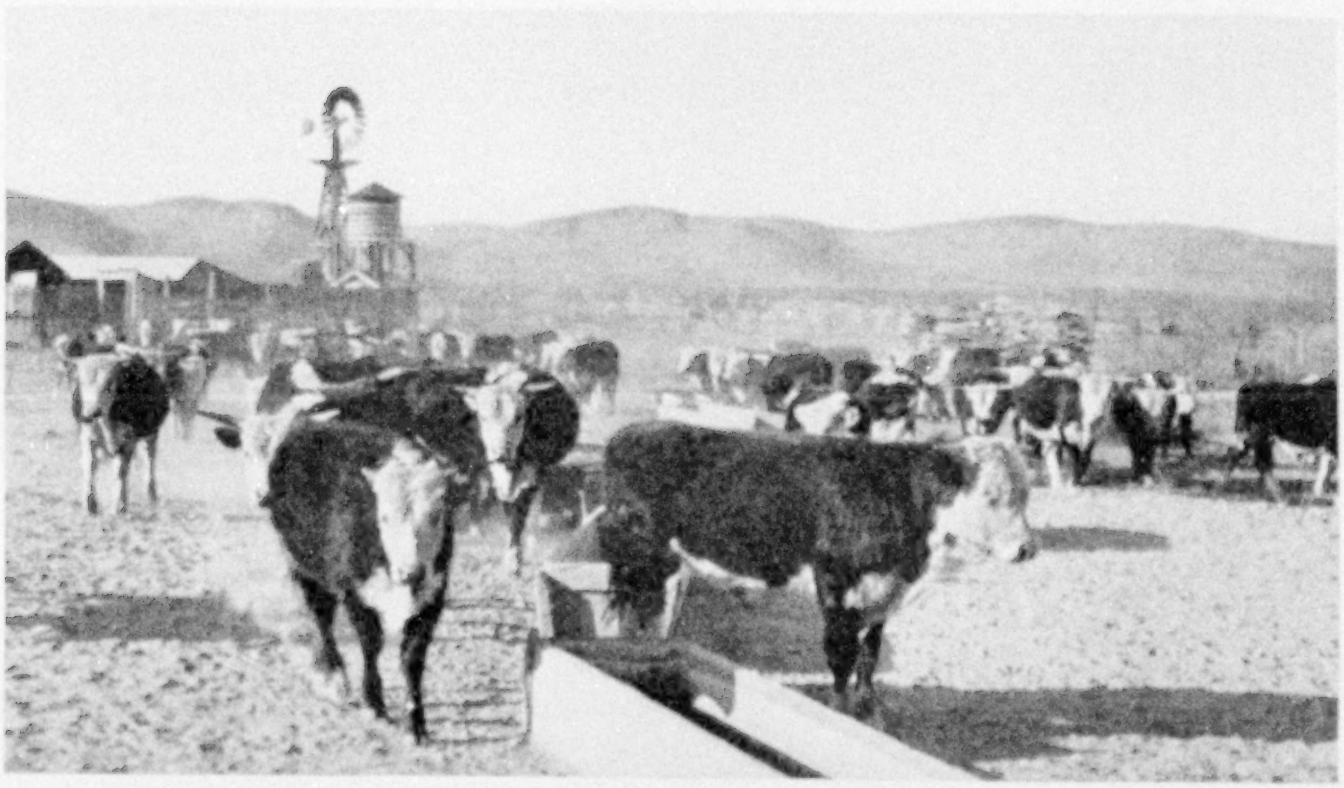
Franciscan monks built this section in 1744 as the chapel of their mission. It is famous now as the citadel of Texas liberty. Within its stone walls James Bowie, David Crockett, William B. Travis, and about 180 other heroes made their last stand against the Mexican general, Santa Anna, with more than 2,500 men. Afterwards, "Remember the Alamo" became the Americans' battle cry against Mexico. To-day the Alamo is used as a museum, exhibiting many old documents, weapons, and other relics of the eventful history of Texas under six flags.

a little more than 100 years ago, the Texas population, including Mexicans and Indians, was probably not more than 8,000 or 10,000. In the next quarter of a century the State had only 100,000 white inhabitants and 35,000 slaves. Not till railways began to spread, in the seventies, was its growth at all rapid. In the last 20 years it has gained more than 2,000,000.

RAILROADS AID GROWTH OF TEXAS'S POPULATION

From the Middle Western States, since 1920, more than 100,000 people have come each year to settle in Texas. Railway traffic records show this. Of these immigrants, 86 per cent have settled in towns and cities. The remaining 14 per cent, going to the country, have put close to 2,000,000 acres of new land into crops. Since the end of the World War, it is estimated that probably 600,000 people have settled on new farms in the vast Panhandle region.

The enormous agricultural potentiality of Texas is shown by the fact that, although less than half of her arable land has been put under cultivation, yet in a



© J. F. Gandara

WHITE-FACED CATTLE ON A WEST TEXAS RANCH

THE STORY OF THE ECONOMIC GROWTH OF TEXAS IS TOLD BY COW BRANDS

Spaniards first brought cattle to the Southwest. They also first used the riata, and the early vaquero was forerunner of the cowboy. To identify their wandering animals, Spanish ranchers in Texas introduced branding. Each owner used an individual symbol—a character or group of characters. These "irons" were heated and their imprint burned into the skin of an animal's shoulder, flank, or hip. This practice continues. To immortalize the history of the Texas cow business and its importance as the State's original great industry, 32 famous old brands have been chiseled on the walls of Garrison Hall, of the State University. This venerable cow-puncher, visiting a museum, examines an iron he used 40 years ago.

Photograph by Willis T. Lee

SEEKING LOW, EASY LEVELS, RAILWAYS THROUGH TEXAS MISS MANY OF ITS MORE SCENIC REGIONS

Far away on a hazy, purple horizon, as one's train rushes through west Texas, may arise the faint skyline of a rugged world. Close to it train-riders never come, but from El Paso or Marfa, by motor and then horse, one may explore the scenic wonders of this isolated region. The approach to the summit of El Capitan, with salt flats 7,000 feet below.

good year she produces a billion-dollar crop (see illustrations, pages 665, 670, 671, 672, and 673).

These facts, and the undeveloped mineral deposits of the State, must be considered in any speculation as to her future growth.

More than a billion dollars' worth of oil has been produced by Texas in five years and the State probably has more lignite, or brown coal, than the whole famous Ruhr region of Germany. Her deposits run into billions of tons. No one knows how much. Her industrial population, though long of minor consequence, is now increasing fast. Her gross manufactured products for 1927 were valued at more than $1,150,000,000. With her potential farmlands fully cultivated and relative increase in her trade and industries, she could easily support two or three times her present population. To-day her growth, more urban than rural, reveals various towns of from 2,000 to 5,000 people which did not appear at all on the maps of a few years ago.

With her abundant oil, gas, lignite, iron ore, and other minerals, the resulting

A MEXICAN WORKER MAKING PALM-LEAF SOMBREROS

These hats are of native white palm and are beautiful and cool in summer (see, also, page 654).

COWBOYS IN RODEO REGALIA

"The bawl of a steer to a cowboy's ear is music of the sweetest strain;
And the yelping notes of the gray cayotes to him are a glad refrain."

Official Photograph, U. S. Army Air Corps

HOW CAVALRY APPEARS TO AN OBSERVER FROM THE AIR

Fort Bliss, near El Paso, is the largest cavalry post in the United States. Its location on a high, level plateau, in a dry, healthful climate, makes it an ideal ground for year-round mounted drills and maneuvers. For many years the majority of Uncle Sam's troopers have been stationed near the Mexican border.

IN FIESTA GARB

A hundred years ago, when San Antonio was almost entirely Spanish and Mexican, señoritas flirted their fans and cast devastating glances at the swains who "played the bear" outside iron-barred windows.

A SO-BIG PECAN TREE

This "old timer," one in a grove of wild trees growing at Barton Springs, near Austin, is ten feet in circumference. The pecan-nut industry in Texas is about 20 years old. The pecan is the Texas State tree.

WEALTH AND LEISURE BRING CULTURE TO ONCE TURBULENT TEXAS

From this vast and long empty wilderness, generations of hard-working pioneers have evolved a magnificent commonwealth, powerful now, and rich in oil, cattle, cotton, fruits, and vegetables. Schools and colleges rise where once swept only the uninhabited plains, and now the pen is above the pistol. A spring day at Rice Institute, in Houston, where 1,200 young people get free tuition in art, literature, science, and architecture under the will of a pioneer who got rich in Texas and endowed the school.

gradual increase of trade and industry is bound to bring substantial growth to certain Texas cities.

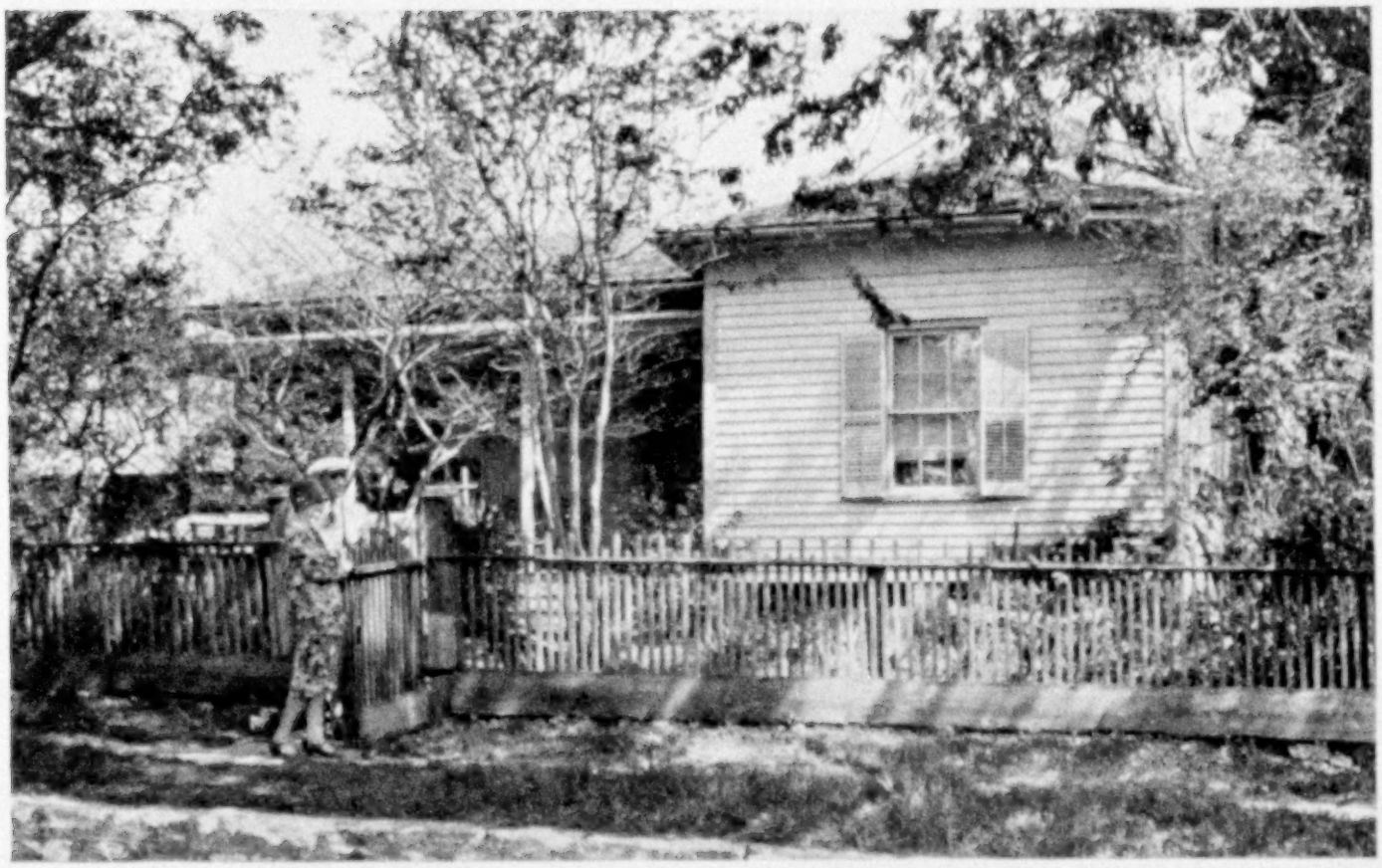
EAST TEXAS IS A STRATEGIC MAP SPOT

On the maps of the United States used by the General Staff at Washington certain little flags are flying. They indicate the strategic cities of America, such as New York, Chicago, San Francisco, and San Antonio, Texas. Besides its place on the map, among the things which give a city strategic importance are safe and adequate food and fuel, in easy reach, and ample transport. In these respects San Antonio, as well as Houston and Dallas, is well supplied.

Consider Chicago. In the middle of what is probably the largest area of productive land in the world, it is a fine example of a strategic city. "Chicago is destined to be the largest city in the world," the late Daniel H. Burnham, famous city planner, was quoted as saying; yet in 1870 Chicago had less than 300,000 inhabitants.

Likewise, Los Angeles in the eighties was a tiny tamale town, and it took more than climate and fruit really to make Los Angeles a city. It took oil—plus other things.

To a singular degree, then, east Texas, with her oil, lignite, and other minerals, her lumber, her excellent means of transport, and her easy access to vast meat,



THE SIZE OF A MAN'S HOUSE IS NO MEASURE OF HIS GENIUS

This modest dwelling in Austin was, during several years of his literary life, the home of O. Henry (William Sydney Porter), master of the American short story.

IN GOOD YEARS TEXAS GROWS MORE THAN 500 CARLOADS OF PECANS

Most of the big pecan crop comes from wild trees, for the heart of this American nut belt is in the river valleys of Texas. Close to 2,400,000 pecan trees grow in the State. Few of the planted groves are yet in bearing. Science, in late years, has developed a tree yielding large "paper-shell" nuts that sell for as much as a dollar a pound. Last year one Travis County tree produced more than 100 pounds of pecans.

TO PAY FOR ITS CAPITOL, TEXAS GAVE THE BUILDERS 3,000,000 ACRES OF STATE LANDS

Facing the business district of Austin, the Texas Capitol, built of native pink granite, is second in size only to the National Capitol at Washington. Texas, on entering the Union, retained title to her public domain. The present-day estimate of the value of the area paid to the Capitol builders is $60,000,000.

Photograph by Maurer

GALVESTON, SEASHORE PLAYGROUND OF TEXAS, DRAWS VISITORS FROM ALL OVER THE MIDDLE WEST

Standing on an island, with a deep, sheltered harbor between it and the mainland, Galveston is one of the most conveniently situated seaports in America. The value of the 1927 exports for the Galveston customs district exceeded half a billion dollars (see, also, page 678).

HER STRATEGIC SPOT ON THE MAP BODES FOR HOUSTON A MAGNIFICENT DESTINY

Tied to Mexico, the West, and the Mississippi Valley by 17 railroads; served from the sea by numerous steamship and tanker lines through its new ship canal, and bound by pipe lines to oil fields as far away as Wyoming, Houston is inevitably a Chicago of the Southwest. Here, in 1928, is being held the National Democratic Convention (see, also, text, page 672).

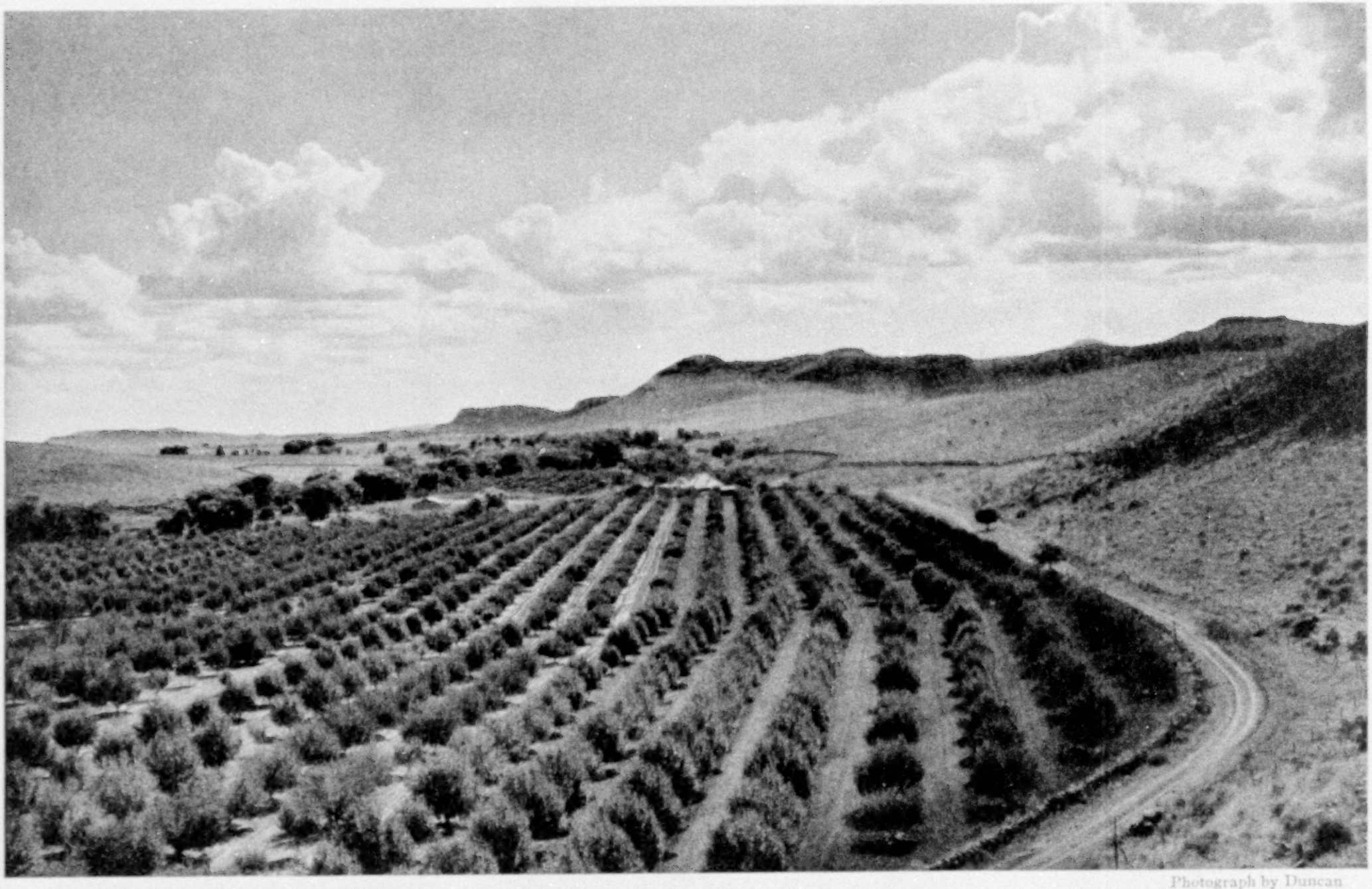
FOR NEARLY 400 SCENIC MILES TEXAS TOUCHES THE GULF OF MEXICO

Through tempestuous years, from the days of the Spanish explorer Cabeza de Vaca and Lafitte the Pirate, down to the stirring annals of the Mexican and Civil Wars, the great Galveston tidal wave and the State's enormous present-day foreign trade in oil, cotton, and grain, Texas has claimed kinship with the sea. Yet, so big is Texas that ranchers on her western steppes are farther from the ocean than are many people residing in Indiana.

© Artcraft

HARVESTING RICE IN TEXAS

As early as 2800 B. C. China observed a ceremony in which the Emperor sowed rice. Indigenous to India and tropical Australia, rice long ago crossed the sea and became the staple food of millions. In the muddy rice fields of the Texas Gulf coast, where tractors would bog down, horses and mules are used.



Photograph by Duncan

AN ORCHARD IN THE WEST TEXAS HILLS

Peaceful, happy homes now rise where once Indians menaced the lives of settlers. At the foot of the mountains in the background still stand the adobe ruins of old Fort Davis, an important United States Army cavalry post in the turbulent days when a gun was part of every man's dress, and nobody's life was safe.

Photograph by Archer

RICH SOIL AND RARE FROSTS MAKE PARTS OF TEXAS A TRUCK FARMER'S PARADISE

Amazing indeed is the rapid growth of commercial gardening in Texas. Early spring gives it the benefit of highest prices. Vegetables are handled by the trainload—in one year, 107,000 tons of cabbage, more than 3,000,000 bushels of Bermuda onions, and astounding avalanches of potatoes, lettuce, spinach, beans, berries, peas, beets, together with 125,000,000 pounds of peanuts! Last year, 133,000 acres were planted in sweet potatoes. Practically this whole huge crop is sold fresh, for Texas has few canneries or preserving plants.

grain and natural gas supplies, is a strategic map spot whereon it is easy to visualize a great southwestern city.

THE LONGHORN LAID FOUNDATIONS FOR FORTUNES AND FARMS

Already Houston is conspicuous. It is the greatest spot-cotton market in the world. On its ship canal it has huge storage for export oil and grain—grain sent from Iowa, Kansas, and Nebraska for Liverpool and Europe. Fed by 17 railways and served by numerous steamship and tanker lines, it trades with the world. Its destiny is one of large possibilities.

In all the kaleidoscopic industrial transitions that are sweeping so much of our South and West, nothing has changed more completely than the Texas cattle ranches (see pages 640, 641).

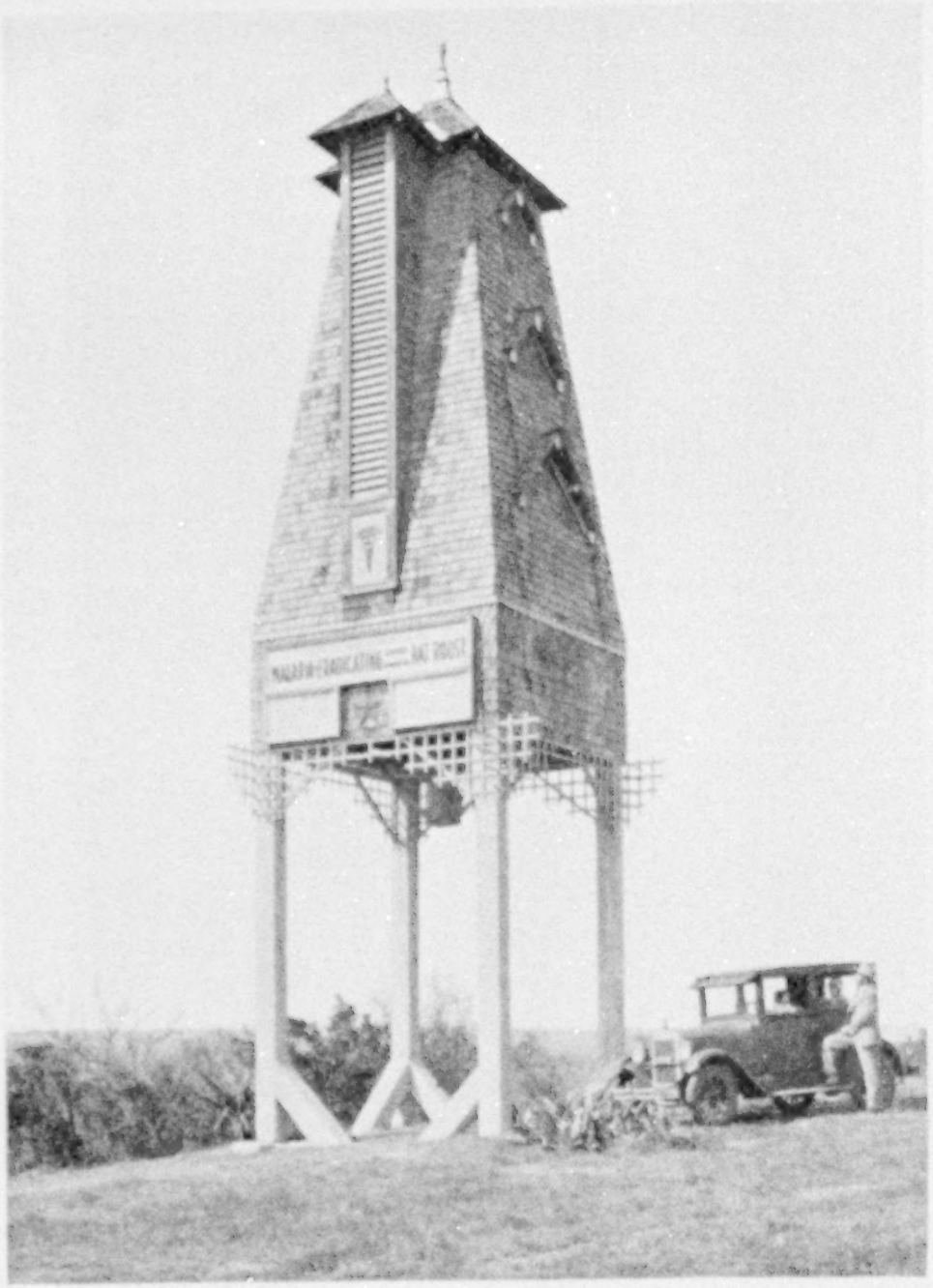
To-day the original high-speed Texas longhorn, that streak of hoofs, horns, and yellow hide that used to run with the deer and wild mustangs, is practically extinct. Yet, in his time, he was the basis of vast fortunes.

IN A TEXAS ONION FIELD

Into the "winter garden" region about Laredo are coming settlers from all over the Middle West. Here Bermuda onions are grown by the trainload. These Mexican girls are hoeing onions near Catarina, a bustling Texas town only three years old.

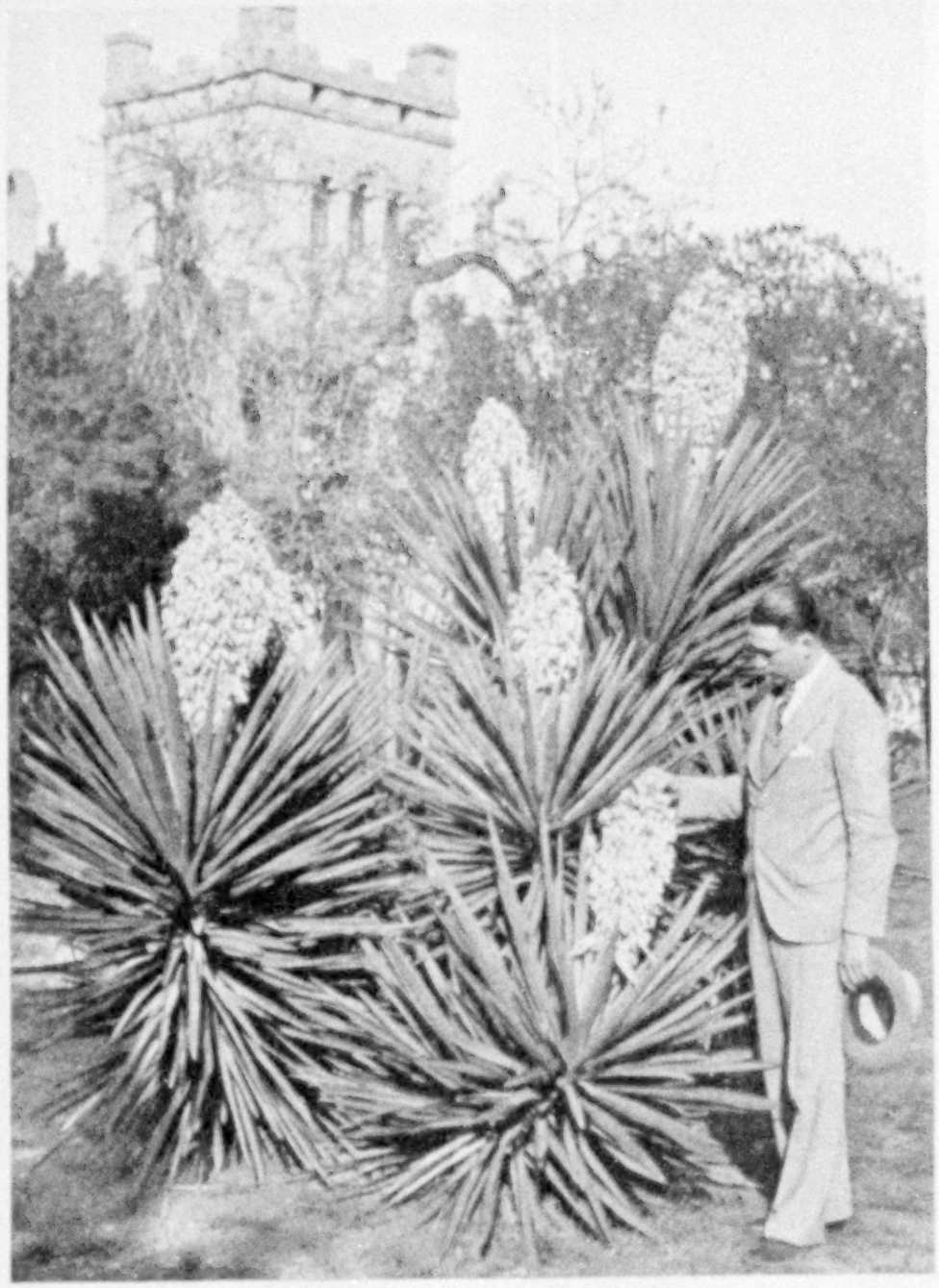
THIS ANGORA GOAT "CLIP" WON THE PRIZE AT A TEXAS FAIR

Back in 1849 the first Angora goats were brought to the United States from Turkey. They were a gift from the Sultan and were taken first to South Carolina. To-day in Texas the raising of Angora goats for their mohair clip, of which each animal yields from three to eight pounds, has become a very profitable industry, with a production in 1927 of more than eleven million pounds.



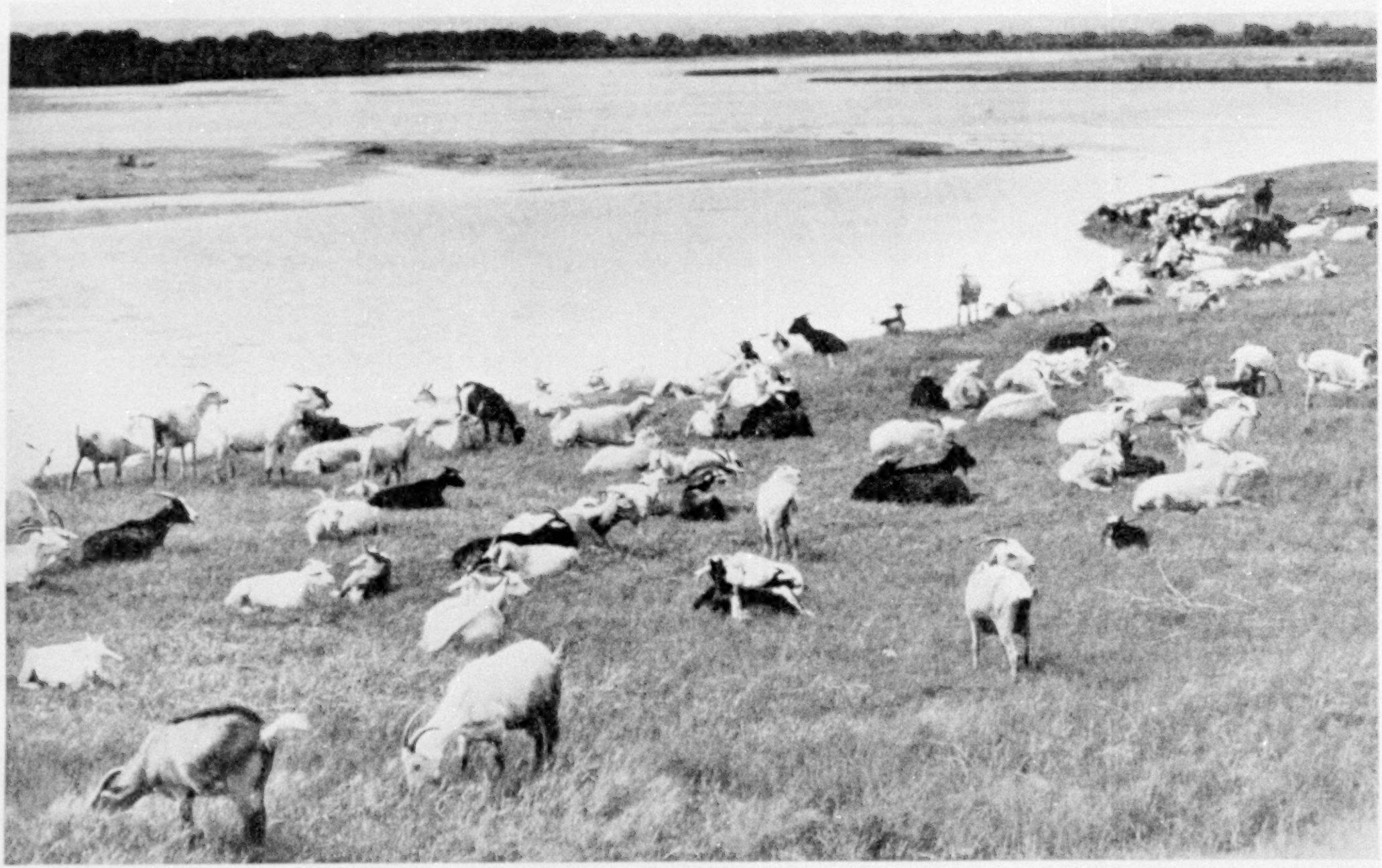
SAN ANTONIO GIVES BATS FREE LODGINGS

Bats eat mosquitoes; so San Antonio provides these bathouses, from whose slat-shaded windows thousands of bats flutter at dusk, on mosquito hunts. At dawn they fly back, to sleep by day in their dark retreat. Bat guano is also collected from these houses.



WILD DESERT PLANTS ADORN MANY FORMAL GARDENS IN TEXAS

A "Spanish Dagger" of the Yucca family (see, also, illustration, page 648), in bloom on the grounds of the Elizabet Ney Studio at Austin. This studio, once the home of a famous sculptress, is a mecca for art lovers in Texas.



Photograph by Aultman and Dorman

THE GREEDY GOAT THRIVES AND MULTIPLIES ON SCANT FEED WHERE CATTLE WOULD STARVE

The daring digestive feats of this capricious creature—ranging from tin cans to old shirts and waste paper—have long been a favorite theme of low comedy. To-day the drier, rougher parts of Texas support thousands of bleating flocks, often tended by Mexican boys.

ROBINSON CRUSOE COULD ONLY DREAM OF A GROUP LIKE THIS

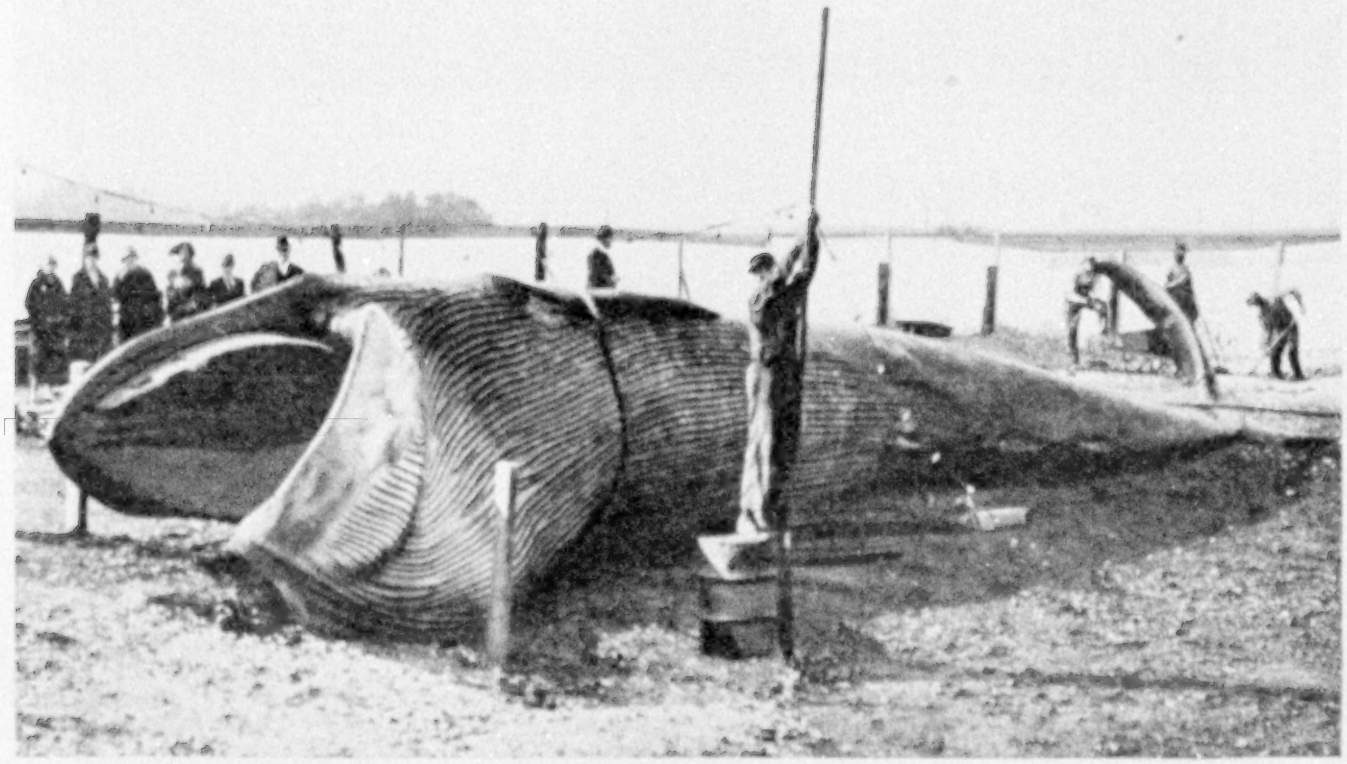
Though minus her classic pipes and garbed in unromantic knickers, a modern Texas nymph of Pan cares for her pedigreed Swiss Toggenburg kids on a model goat farm near Fort Worth. That philandering sycophant, the fickle, ubiquitous goat, thrives on the rough forage of Texas. Goat's milk for use in nurseries and hospitals is in great demand and retails for 40 cents a quart.

When Texas, in the seventies, began shipping meat to London and underselling European producers, even Parliament took notice of the Texas steer and sent official missions to run after him and study him. Then titled plutocrats came, bought ranches, and herded longhorns. Writing about this longhorn, J. Frank Dobie says:

"Financially, the longhorns saved Texas during the dark days that followed the Civil War. They restored the credit of a bankrupt land and they laid the foundations for fortunes and farms, the value of which to-day is hardly to be estimated.

"The Texas longhorn not only saved Texas from financial ruin, but went far toward redeeming from the wilderness vast territories of the Northwest. Somebody has said that civilization follows the plow. West of the Missouri the plow followed the cowboy, and the cowboy followed a longhorn from Texas. Those were the days when Texas men called themselves and were called 'longhorns.' They were proud of the name, and they spoke with contempt of that class of men called 'shorthorns.'"

With the banished longhorn there also passed from this wild-cattle arena most of those rollicking, hard-riding, quick-shooting heroes whose names still live in the old cowboy ballads.



Photograph by Trost

A WHALE OF A STORY FROM THE BALMY GULF COAST

This 50-ton leviathan grounded near the great oil-shipping city of Port Arthur. With ropes, men in a launch tried to tow it up a canal; but it broke loose and started to sea, only to kill itself in collision with a jetty.

Photograph by Underwood & Underwood

A ROAD RUNNER TEASING A RATTLESNAKE

Every man who knows the Southwest is familiar with the shy, long-tailed chaparral cock, or "road runner," and his swift but odd, loping wabble. If while running he wants to stop quickly, he sticks his long tail straight up and brakes with it against the wind. His diet includes lizards, beetles, and small snakes. The belief is common that he kills rattlers, but investigators say, "Not proven."

AS A GREAT DISTRIBUTING CENTER FOR THE SOUTHWEST, DALLAS RELIEVES THE TRAFFIC STRAIN ON ST. LOUIS AND KANSAS CITY

Here literally scores of nationally known business enterprises have built warehouses. On busy days, over 200 package cars of goods leave Dallas for 11,000,000 consumers who live within a radius of 300 miles. This recently completed viaduct is more than a mile long.

BEAUTY AND FASHION PARADE IN SAFETY BEHIND GALVESTON'S SEA WALL

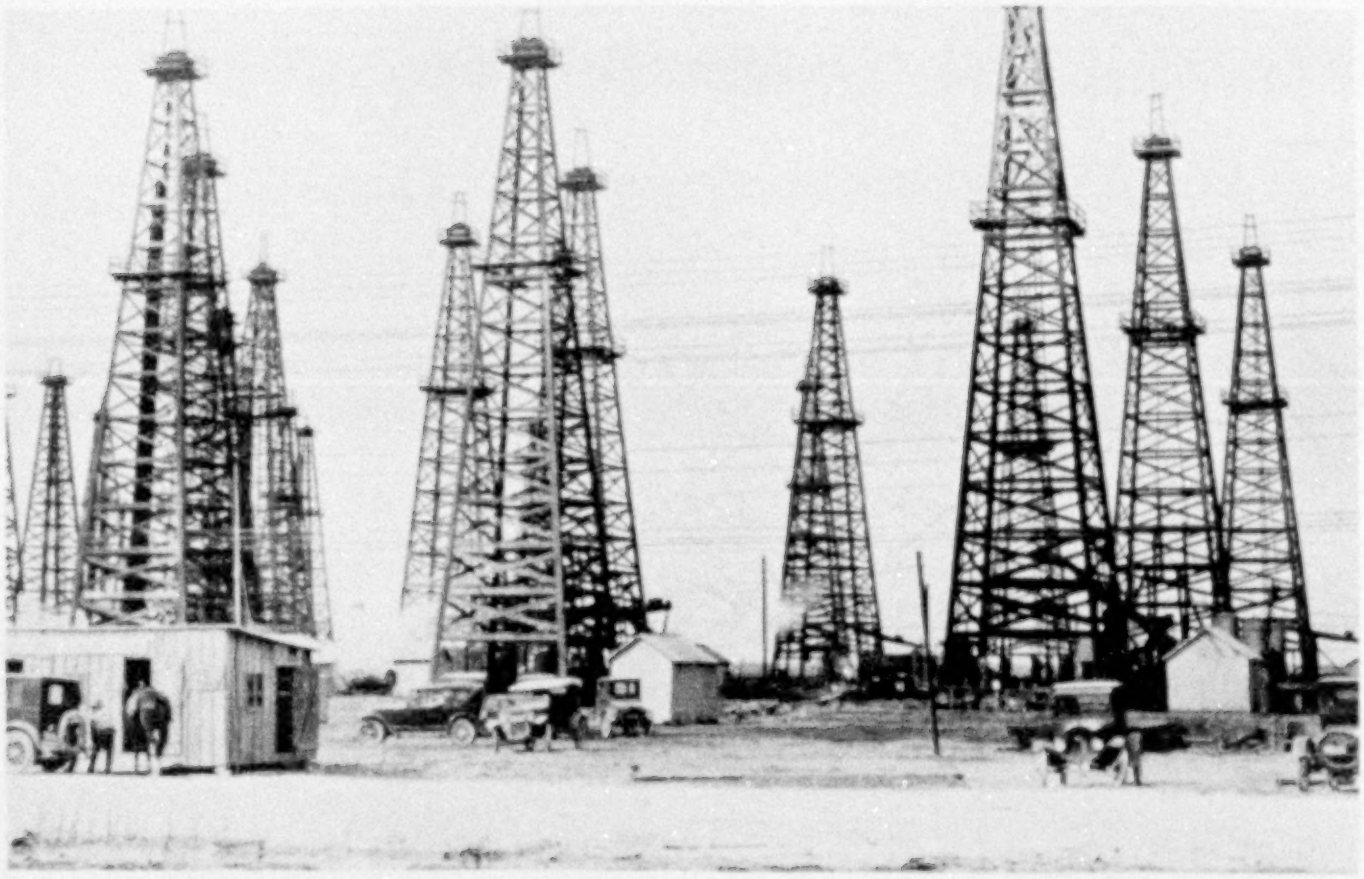
From that black September of 1900, when hurricane and tidal wave spread destruction, Spartan-hearted Galveston, phœnixlike, rose anew from death and wreckage. To prevent similar calamities, the level of the city was raised an average of 7 feet and a concrete wall 17 feet high and 5 feet wide at the top was built to protect its entire Gulf frontage. The splendid boulevard adjoining the wall is a rendezvous for bathers and seekers after sea air and sunshine.

MOTHER EARTH SNORTS SMOKE AND FIRE: A BURNING OIL WELL

Last year Texas produced nearly 214,000,000 barrels of oil, more than one-sixth of the estimated production for the entire world. The value of this production has not been estimated, but the State's smaller oil flow in 1926 was worth $308,700,000.

A MEXICAN WEAVER OF SERAPES AT HIS LOOM IN EL PASO

Forgotten Aztec artists designed these patterns when Mexico was a center of pagan culture in the Western World. Now, in weaving, in painting, ceramics, and design, modern Mexicans seek to revive ancient Indian arts.



SOME OF THESE OIL WELLS AT SPINDLETOP ARE NEARLY 5,000 FEET DEEP

With a new Texas field found almost every year, the State's oil production tends to overtake the cotton crop in value. In 1927 Texas produced more oil than the entire United States produced in any year prior to 1912.

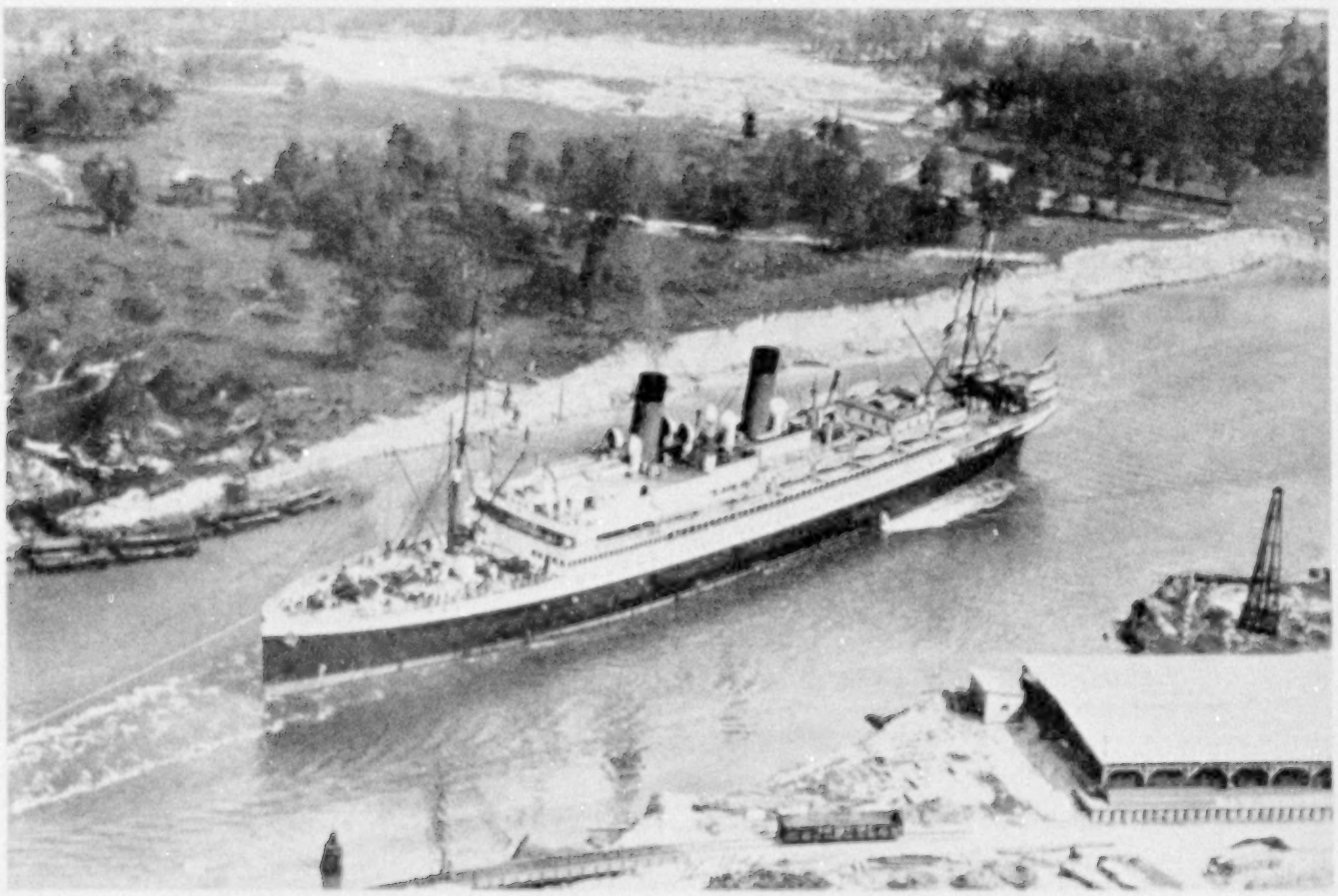
Photographs courtesy U. S. Bureau of Mines

TWELVE TANK CARS OF TEXAS HELIUM GAS FILL THE DIRIGIBLE "LOS ANGELES"

When chemistry, experimenting in laboratories, first made helium gas by breaking down uranium ores, it cost $1,500 to $2,200 a cubic foot. Now, at a Fort Worth extracting plant, helium is taken from natural gas for about three cents! The helium in these cylinders is under a pressure of 2,000 pounds per square inch.

THE BLUEBONNET IS QUEEN OF THE TEXAS FLORAL EMPIRE

Chosen by the Legislature as the State flower, the bluebonnet rules a range more limited than do most State flowers. The Texas plant blooms in spring over a large part of the State and transforms many a sandy waste into an oasis of color.



Photograph by Captain R. W. Mackie

OCEAN LINERS USE THE NEW SHIP CANAL UP TO HOUSTON

In her magic transit from village to city, Houston outgrew the bayou that formed her path to salt water; so she dug her way to sea. Up through this man-made channel and into her big turning basin come now the ships that shuttle the world's trade. The canal is 25 miles long and has a depth of 30 feet.

"TAPESTRY IN STONE"

An exquisitely carved window flowers from the ruins of the Mission San José de Aguayo, four miles south of San Antonio. Like the mission's statues and other ornamentation, it was the work of a Spanish sculptor who was sent over by the King of Spain and who spent the best years of his life in beautifying this loveliest of the string of missions extending down the San Antonio River. The window was removed for exhibition in 1904, at the World's Fair in St. Louis, and later restored to its original place.

When barbed wire was invented, romance and adventure died—on the Texas plains. Freedom was no more.

THE LARGEST NATURAL COW PASTURE IN THE UNITED STATES

Yet, even if the open range is gone, no carnivorous American keen on T-bone and prime ribs au jus need contemplate the necessity of eating reindeer, musk ox, or other meat of the Arctic. For 25 years we've worried about a possible shortage of beef cattle; but somehow they still keep arriving at the stockyards in undiminished millions.

As to Texas, the climatic, geographic, floral fact remains that she is still the biggest natural cow pasture in the United States. At this very minute millions of bulky bovines are quietly feeding and fattening inside the wire fences of Texas (see illustrations, pages 640, 641, 650, and 659).

Bigger and better meat-bearing animals—that is the modern Texas cowman's slogan. Gradually building up the herds—no yearly models but constantly improved. To get a husky, fever-resisting beast for the low coast lands, the canny Texans have crossed their native cattle with the great humpbacked Brahmans of India.* And all through the cow country one sees literally hundreds of thousands of bovine giants, dominated by white-faced Herefords, straight of back and heavy with meat.

In good years the Fort Worth market alone will receive more than 1,000,000 cattle, as well as, perhaps, 1,250,000 calves, sheep, and hogs.

"Since 1920," said the Industrial Commissioner of Fort Worth, "as near as we can ascertain, from 500,000 to 600,000 new settlers have entered west Texas. This doubtless has been the most significant agricultural movement in the country in the past decade. But it is our belief that even if many big cow ranches are being cut up into farms, this will not result in any shrinkage of the cattle business. West Texas will hardly become a one-crop country. Taking their cue from the older settlers, the newcomers are accumulating bunches of livestock."

* See, also, "The Taurine World," by Alvin Howard Sanders, in the NATIONAL GEOGRAPHIC MAGAZINE for December, 1925.

Also, despite the spread of farms, vast areas of Texas are still held in the form of big cow ranches, and probably always will be. Much land is better for this than anything else. "The right side of the soil is on top now," you hear southwest Texans say—meaning that the natural grass is worth more than any farm crop these lands could ever grow if plowed up.

GRIZZLED VETERANS OF CHAPS AND SADDLES ARE PASSING

Barbed wire, after all, was a necessary evil. But it was hard at first to make the old-time, open-plains cowman believe this. To him the snorting, fighting longhorn was a far better sporting proposition than the sleek, slow steer of to-day, that has to be salted and cuddled, sheltered and doctored.

These pioneer cowmen are fast passing. Here and there in the big cow country, the surviving grizzled vets of the chaps and saddles who punched cattle in the eighties hold their noisy reunions, reviving memories of days long ago. They spin yarns of Indian fights and buffalo hunts, of drives up the trail when there wasn't a farmer or a wire fence between the Red River and the Wyoming line, when professional hunters with one-shot Springfields slew buffalo only for their hides and to save grass for cattle.

For these pioneers, some unknown cowboy bard has spun this plaintive ditty:

"Backward, turn backward, oh time on your wheels,
Airplanes, wagons, and automobiles;
Dress me once more in a sombrero that flaps,
Spurs, a flannel shirt, slicker and chaps;
Give me a six-shooter or two in my hand,
And show me a steer to rope and to brand,
Out where the sagebrush is dusty and gray,
Make me a cowboy again just for a day.

"Thunder of hoofs over range as we ride,
Hissing of iron and smoking of hide;
Bellow of cattle and snorting cayuse,
Longhorns from Texas as wild as the deuce,
Midnight stampedes and milling of herds,
Yells from the cowmen, too angry for words;
Right in the midst of it all I would stay,
Make me a cowboy again just for a day."

So, while the nature of the Texas cattle industry has changed, its output in net pounds of meat is still prodigious. In fact, it will probably increase. Following the price slump in 1920 came years of drought. Herds diminished. Now, with

SO MUCH LIKE SPAIN, OR THE DOORWAY OF SOME ANCIENT CHURCH IN MEXICO—YET THIS IS TEXAS

Texas was long a part of Mexico. To this day Mexican influence on its habits of life is plainly visible, especially in the border counties. To its already numerous Mexican population, Texas adds thousands every year, as its growth draws new armies of workers from below the Rio Grande. This is old Concepción Mission, near San Antonio.

SAN ANTONIO ARCHITECTURE, OLD AND NEW, AFFORDS A STRIKING CONTRAST BETWEEN EARLY SPANISH CHURCHES AND MODERN SKYSCRAPERS

At the left of the new office building stands the San Fernando Cathedral, old when Texas was a republic. It served as headquarters for General Santa Anna, before his advance on the Alamo, in March, 1836.

better prices and seasons of ample rain, grass is good and cowmen face a period of reviving prosperity.

Measured in dollars and cents, Texas cotton is above cattle. Cotton, in Texas, is above everything. But nothing is above cattle in the sentiments and memories of Texans. To keep alive and spread the fame of Texas cow kingdoms, 32 historic cattle brands have been carved on the walls of Garrison Hall, newest building on the campus of the State University at Austin.

COTTON IS KING IN TEXAS

When Cabeza de Vaca crossed Texas in 1535 the Indians gave him garments of cotton. From the few plants of those early days there has developed a production of astounding magnitude. At times Texas's crop has amounted to more than 40 per cent of all cotton grown in the United States. In the record year, 1926, it reached the amazing total of 5,630,831 five-hundred-pound bales.

Weevils have lowered the quality, and bad farming has cut the production per acre; yet, by planting more and more land, the crop has gradually increased. Since 1921 about five and a half million additional acres have been planted to cotton.

In this quest for new land, the State found that cotton would grow on her upper levels, in the higher country of west Texas. Here a most promising area has been found, one that so far is free of weevils, and that also grows the staple

MOST OF THE SULPHUR AMERICA USES COMES FROM TEXAS

By hot water and steam, forced down holes as deep as 1,500 feet, sulphur is melted; then pumped into huge wooden vats at the mines, where it solidifies. For shipment, the sides of the vats are removed, and the sulphur is sometimes blasted to load into railway cars. Ships are loaded by steam shovels from the bins on the docks at Galveston, the chief sulphur port of the United States, which is near the Matagorda and Brazoria County deposits, two of the greatest sulphur-producing fields in the world. Last year America's production of sulphur exceeded 2,000,000 tons, of which Texas supplied practically all. Sulphur now is used in the manufacture of sulphuric acid, matches, gunpowder, and fertilizer.

cotton for which European and other mills are so often asking.

The brain of all Texas throbs day and night on this cotton question. Decades of cotton study have given her a world-wide cotton vision. She is not blinded to the fact that world cotton crops may shift; that some day, so far as her exports to Europe are concerned, her leadership may be challenged. She knows how hard England is seeking to grow cotton somewhere in her colonies for her home spindles, to be less dependent on us; so even a mere rumor that, somewhere in Africa, England's cotton land quest is about to be successful is enough to worry Texas.

"It seems Texas must gradually grow an ever-increasing share of all cotton produced in the United States," said one experienced planter. "And, while weevil-free lands on the upper levels of Texas are a great desideratum, any sudden large expansion would be risky.

"So long as cotton brings $100 a bale or more, the world will keep on planting more and more acres and hunting harder for new cotton areas. So far, Nature somehow has seemed to limit production by local bad seasons and pests. But if we all continue to increase acreage, Nature may some day play a joke on us and yield a world crop so big as to reduce the price to $50 a bale. Then all cotton land values, net revenues, in Texas and everywhere else, would have to be revised."

A TEXTILE INDUSTRY IS BEING DEVELOPED

Taking a leaf from the book of North Carolina, Texas is beginning to build up her most obvious industry, the cotton mill. She enjoys three of the most vital factors for their profitable operation: adequate labor, cotton "at the gate of the cotton patch," and fuel for power.

Like North Carolina, also, Texas is setting about methodically to make the most

Photograph by Paul Verkin

WITH HUGE STORAGE WAREHOUSES AND QUICK LOADING FACILITIES, GALVESTON HAS BECOME AMERICA'S LARGEST COTTON PORT

of all her natural gifts. The newly formed Society for the Scientific Development of Texas Natural Resources is just what its name implies.

TEXAS POTASH DEPOSITS MAY FREE UNITED STATES OF FOREIGN MONOPOLY

Vast as many resources of Texas are known to be, further surveys must yet be made to determine the best local industrial use of the many mineral deposits which exist. Already the annual mineral production, exclusive of oil, is valued at $70,000,000.

Take potash. A thorough survey of the Texas deposits may reveal enough of these salts to make the United States forever independent of the present French-German potash monopoly. Often, in drilling for oil and water, high-grade potash is found; but the extent of these deposits remains to be learned.

Texas produces $50,000,000 of net surplus wealth each year. It is the aim of the Scientific Society, by publishing freely the results of its surveys, to aid this home capital in the development of mining and industry.

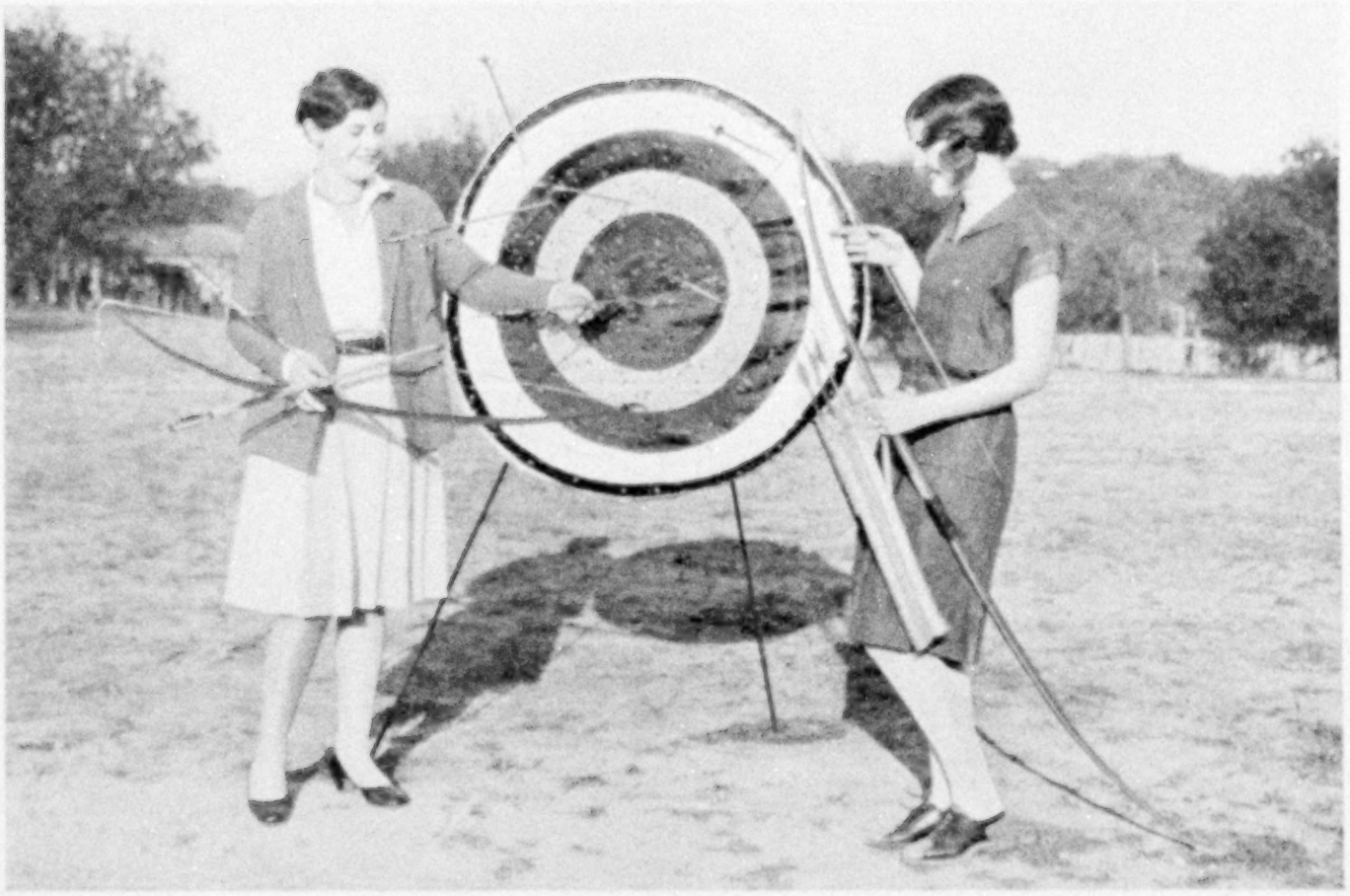
This development of Texas is not so much a question of outside capital, as it is of assembling data and educating native Texans to put their savings into new local industries.

The bulk of Texas wealth is already owned within the State. Most of her big foreign corporations either operate under Texas charters or else under special State laws designed to protect Texas people. Foreign insurance companies, for example, are required to invest in Texas a large share of their reserves. In many such foreign corporations, especially the public utility companies, Texans already have large holdings.

A SPAWNING GROUND FOR FARM POLITICS

Texas, never a territory, entered the Union on her own terms. Shrewdly, she kept title to her own public lands. Half this vast domain she gave to her schools. Her university received more than two million acres. Oil found on these lands has made the University of Texas very rich.

Texas, like Iowa, is the spawning ground of farm politics. Here was born



THE SNAP OF A BOWSTRING WAS NO WELCOME SOUND TO TEXANS OF AN OLDER GENERATION

In an archery class at the State University fair co-eds find sport with bow and arrow—a deadly weapon in the days when Texans themselves were its target.

the historic Farmers' Alliance, progenitor of the People's Party. After years of experimenting and disappointment with one or another political panacea, coöperative marketing developed. To-day, especially in the sale of cotton, wool, alfalfa, poultry, and to some extent in livestock, it is increasing fast.

More than two-thirds of all Texas people live in the country. They support nearly 900 papers and magazines. Here the local paper, like the country preacher and the village lawyer, wields a very strong social influence. It is closely read, particularly for farm, livestock, and local political information. You can understand this dependence on the local paper when you stop to think how far many Texas towns are from a city daily. Scores of Texas counties boast no towns of more than 2,500 people.

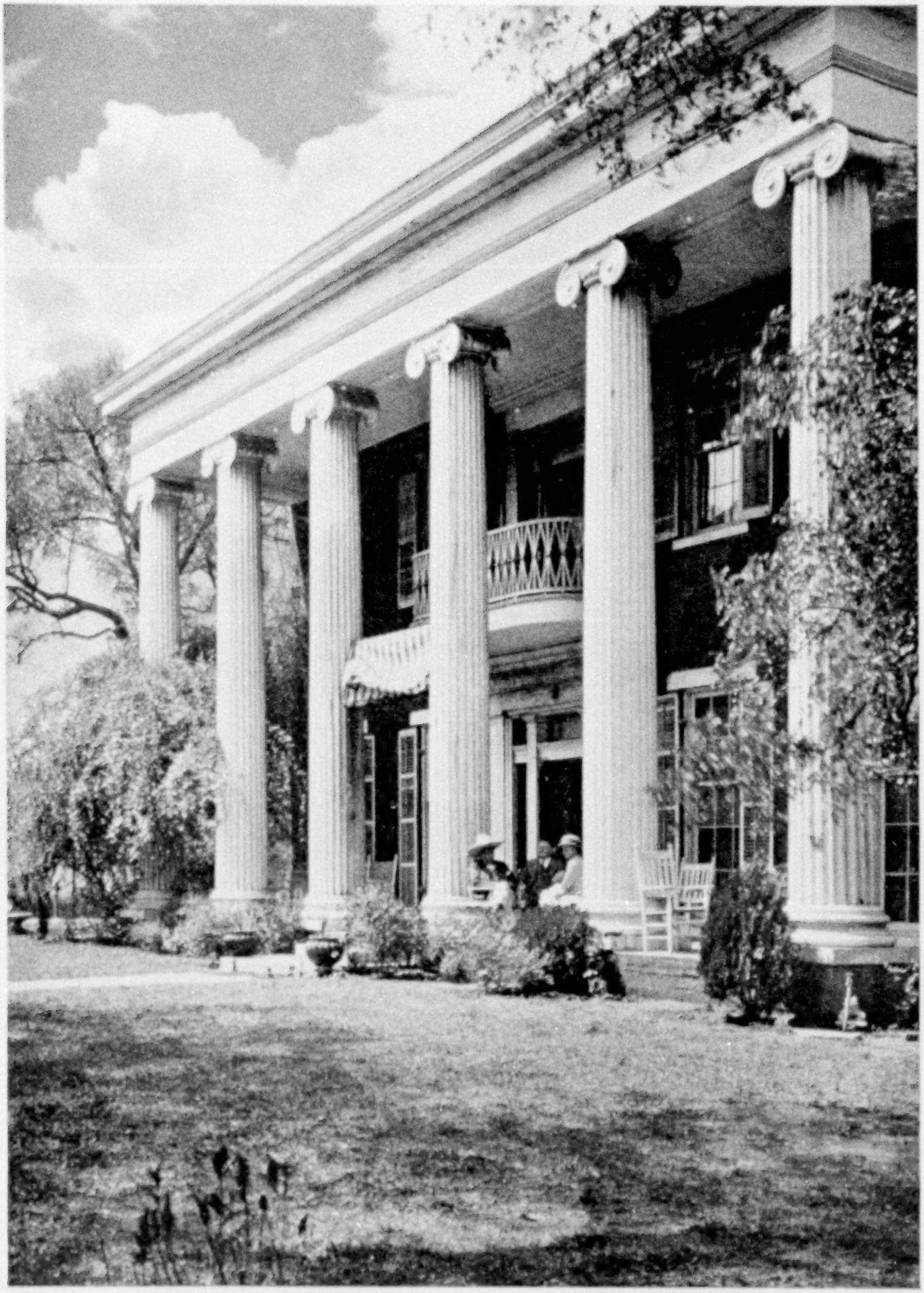
COUNTY NAMES IDENTIFIED WITH PIONEERS AND BATTLEFIELDS

Born Texans are pure American folks (such as you still find in east Tennessee and elsewhere in the South). They use many old Anglo-Saxon words and old-style pronunciations. Foreign infiltration, except for Mexicans and a few German colonists, has been small.

Many counties are named after pioneer Americans. There's a Jeff Davis and a Tom Green county, a Jim Wells and a Jim Hogg county, and one named Deaf Smith, in honor of one of Houston's officers in the fight against Santa Anna.

The advent of easterners and middle western hosts has not made much of a change in the original Texan's nature. He's still the bold, self-assertive, independent soul that he was in the days when his ancestors died in the Alamo or helped Houston defeat the Mexicans at San Jacinto.

Loyalty to friends is almost a religion. "My father went broke in the cow business—lost a million," a Texas girl told me. "When we were rolling in wealth, I finished in Europe, skated at St. Moritz, got presented at court, and all that. But Texas is home, sweet home, to me. You can lose your money here without losing your friends."



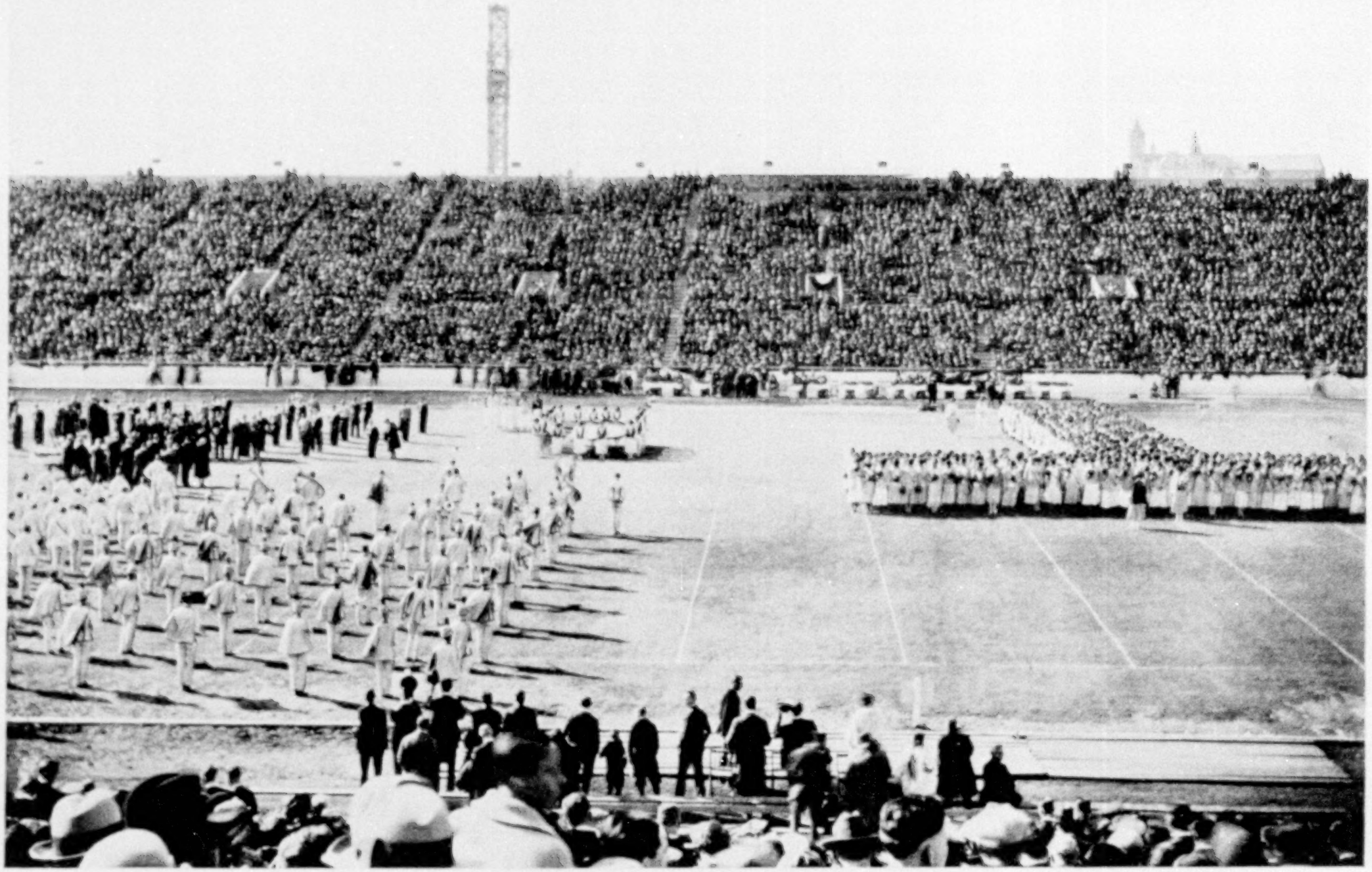
TRADITIONS OF THE STATELY SOUTH LINGER HERE

In the suburbs of Austin stands this fine old mansion, built in 1843, which was once occupied by Elisha M. Pease, twice Governor of Texas. It is one of the best-preserved examples of Southern architecture in the State and furnishes a key to the residential character of the capital, which has always remained a city of homes, churches, and schools, rather than one of shops and factories.

IN ITS EVENTFUL HISTORY, SIX FLAGS HAVE WAVED OVER TEXAS AND ITS CAPITAL HAS BEEN MOVED SEVEN TIMES

When Mexico put off the yoke of Spain, over a century ago, American migration to Texas increased. Following the plan of Moses Austin, his son Stephen, under a permit from Mexico, settled several hundred families on the banks of the Brazos. Austin, the State capital, was named for him. Looking down Congress Avenue, Austin, through an archway in the capitol building (see, also, page 666).

MUSEUM



Photograph by University Studio

THE UNIVERSITY OF TEXAS DEDICATES ITS MEMORIAL STADIUM

Approximately $500,000 has been spent to date on this immense structure on the new campus. The part already completed seats 42,000. The university's greatest trouble since it opened, in 1883, has been growing pains, with the student body outstripping the equipment. However, since it "struck oil," the once land-poor institution is looking forward to an income of millions, much of which will be dedicated to a building and expansion program (see text, page 688).

ITS FLEECE WAS BLACK AS COAL!

Because its wool is so fine and curly, the fleece of the young karakul lamb is much used in place of fur. A flock of karakul sheep is being bred in the Rio Grande Valley near El Paso, original rams and ewes having been imported from Bokhara (see "The Land of the Lambskins," by Robert K. Nabours, in the NATIONAL GEOGRAPHIC MAGAZINE for July, 1919).

Hosts of Americans have seen Texas from the windows of transcontinental trains. To such train riders it seems largely a flat, dry, almost treeless country. That's the fault of men who located the railroads. It's the same in Arizona. Railways don't haul you over high, scenic drives, like sight-seeing busses — not if they can help it. They seek the easiest way. In the Southwest this is often over level deserts, over minimum grades, dodging the mountains, with their pine trees and trout streams, whenever they can.

Parts of Texas, like the great barrancas of the Panhandle, or the Santa Helena gorge in Brewster County, are wild and picturesque. Cross-country train trippers killing time at bridge between Kansas City and Los Angeles, see nothing of these rougher, wilder regions. Likewise, by hundreds of miles, they miss the verdant, fruitful, subtropic Gulf coast, with its palms and beaches, its pleasure resorts, and its busy, growing tourist traffic. From all over the Middle West increasing numbers of visitors go now each winter to Galveston, Corpus Christi, and other Gulf towns.

A GREAT CITRUS-GROWING REGION

Farther south and along the Rio Grande, there is to be had some of the best hunting in the United States.

Here, too, between Laredo and Brownsville, has developed rapidly a vegetable- and citrus-growing region of wealth and importance. Some of the finest grape-fruit grown in the United States come from this particular spot, and the big, sweet Bermuda onions from the Rio Grande Valley have achieved prime place in our markets. Because of climate, soil, ample water, and improved transport, this and other choice parts of Texas will attract more and more settlers as the years pass.

Much of the land of Texas is still priced comparatively low—low enough, in truth, to yield a higher net return than the profits usually earned on similar lands elsewhere; and these land values rise, of course, as inhabitants multiply.

HORSES WERE UNKNOWN IN AMERICA WHEN THE SPANIARDS CAME

Fossilized remains of ancestral horses have been found in the United States, but our equine race of to-day, together with sheep and cattle, came with the Conquistadores. Of late years the Mexican army has bought many mounts in Texas. This herd is drinking near San Angelo.

Superlative Texas! Her governor rules more territory than any king or premier of Europe has in the continental limits of his country, Russia alone excepted. Here native Americans, starting only with hard hands, strong wills, and great energy, have built up a vast, rich, and powerful commonwealth.

Since General Sheridan spoke his mind a wilderness has yielded to civilization. There is no joke, now, about Texas.

Editor's Note: It is impossible to present between the covers of a magazine the entire story of a great State. A complete description of the multifold industries, interests, and beauty spots of Texas and of each of her hundreds of progressive cities and towns would require volumes. Therefore, the author has in the preceding pages brought into close focus only a representative group of outstanding facts about this commonwealth.

Notice of change of address of your NATIONAL GEOGRAPHIC MAGAZINE *should be received in the office of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your August number, the Society should be notified of your new address not later than July first.*

PHOTOGRAPHING THE MARVELS OF THE WEST IN COLORS

By Fred Payne Clatworthy

THIRTY years ago I left Brooklyn Bridge, New York City, on a bicycle trip across the continent. The West, and especially the Southwest, was to me the great unknown. In New York City, from a certain hill, it was claimed, one could see the abode of ten million people; but out west the natives prided themselves on how many miles one could travel in a day without seeing a living soul.

On the plains of New Mexico the bicycle went to pieces; so, catching some half-wild burros, saddling them with panniers made out of grocery boxes, and carrying a Dutch bake-oven, provisions, and cameras, a college friend and I walked a thousand miles to California by way of the Petrified Forest and the Grand Canyon of Arizona.

We had the usual experiences of early-day explorers. Many ranches were deserted, for the country at the time was terrorized by the famous "Black-Jack gang." The first night, on the San Augustine plains, we stopped at a cattle ranch 65 miles from a railroad.

Late at night three horsemen rode in, tired and spattered with mud. They stacked their Winchesters in a corner and demanded something to eat. In accordance with the New Mexico custom, steaks were fried and "air-tights" opened without questions being asked.

The mysterious visitors "hit the trail" early next morning. Later we learned that they were "Black-Jackies" and had that day held up the mail train at Grant Station and killed one of the clerks. When they stopped at the ranch they were on their way to rob the bank at San Marcial. The trio met the swift justice of the good old days: one was lynched in Utah and the other two were guests of honor at an "Arizona necktie party."

But to resume our journey, which is a picture, not a bandit trip.

We passed through the Petrified Forest and crossed part of the Painted Desert on our way to the world's greatest gorge. It was on this trip that I first discovered the matchless colors of the Southwest—America's finest field for color photography. This was before the days of the color plate, and all we could make were black-and-white negatives—quite unsatisfactory in this land of color, where only color can truly interpret it.

The following year another school friend and I drove a team of mules and a spring wagon 1,500 miles, from Los Angeles to the Grand Canyon by way of San Diego, crossing the Colorado Desert, where now is located the rich Imperial Valley. Only the first surveying parties, laying out the future town sites, were there then.

HARSH INTRODUCTION TO A LAND OF ENCHANTMENT

We were caught in a desert sandstorm, lost our way, and traveled all day by compass across trackless sand wastes, part of the time in old Mexico, camping at night on the mesquite-protected shores of an overflow pond of the Colorado River. We crossed the latter successfully the next day and continued across Arizona to Montezuma's Castle and the Natural Bridge of Tonto Basin.

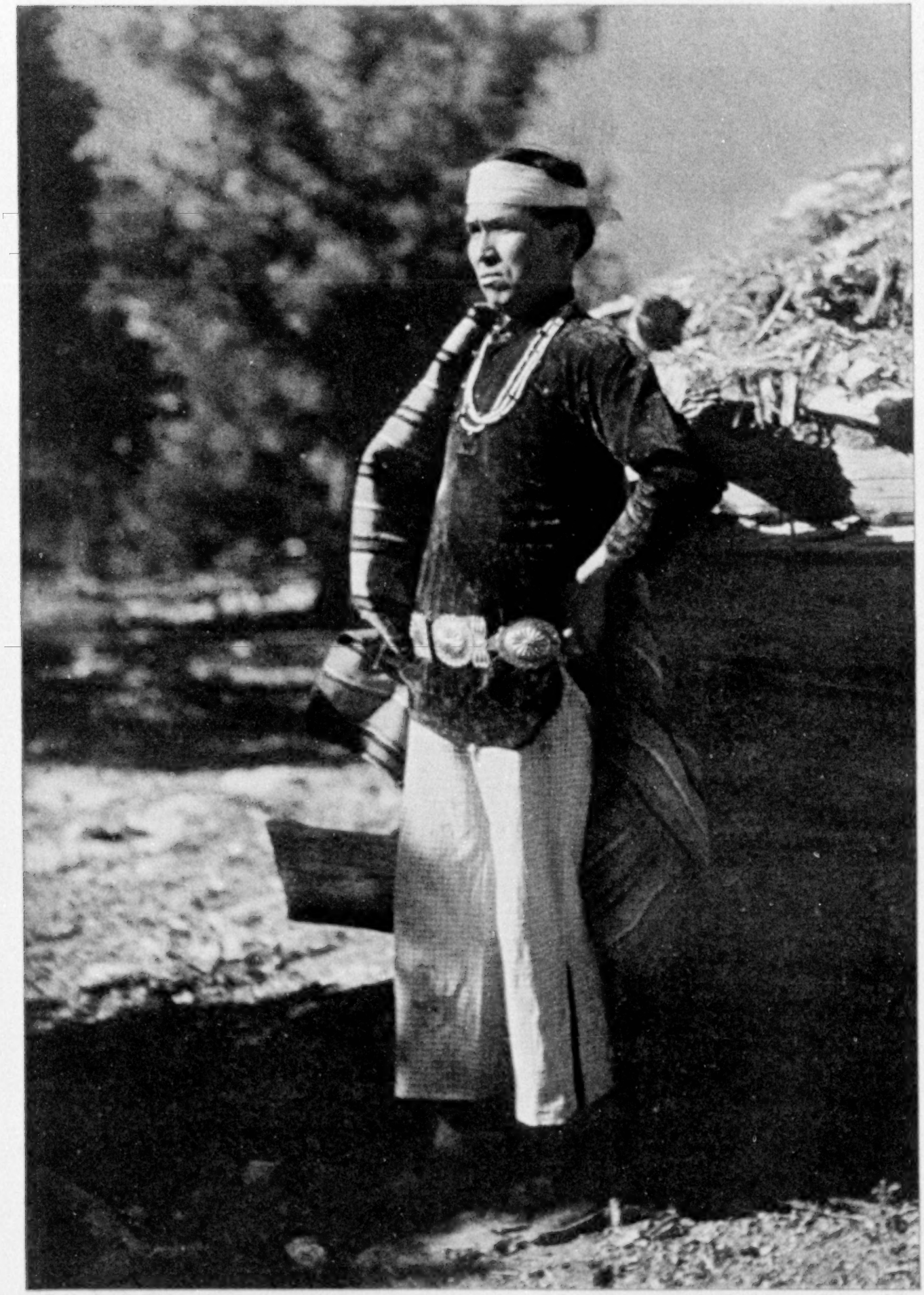
Roads became so rough in Tonto Basin that we had to abandon the wagon temporarily and ride the mules. A brother of old John Hance, of Canyon fame, with a similar reputation for veracity, told us he had once driven a wagon three miles over this same rocky road before he discovered he had lost one of his wheels!

These cross-country scouting trips constituted my introduction to a land of enchantment. Later I was to come back again and again to paint its colors with a color plate and camera lens.

The Grand Canyon's transparent purples and blues defy the artist's brush; it has remained for the autochrome plate to reproduce its exact colors. What is true of the Grand Canyon is equally true of the Painted Desert, Zion National Park, and Bryce National Monument, "that beautiful garden that blossoms in columns of stone."

On a recent trip I had as my companion a veteran Western painter. Zion he attempted with some success, but when he saw Bryce he would not even unpack his kit; he simply said, "It cannot be done."

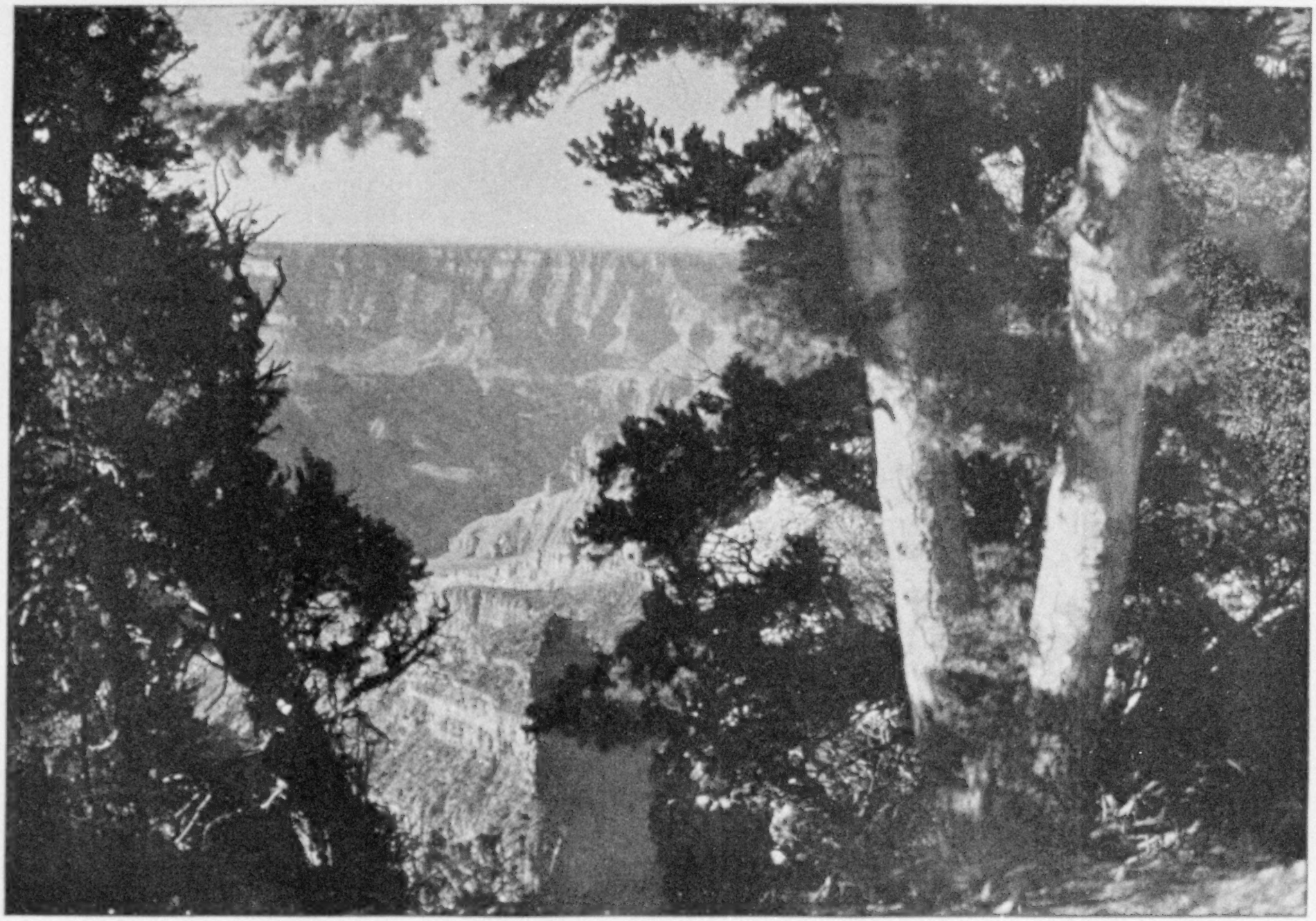
Few readers of the many who now, as a matter of course, look for the natural-



© National Geographic Society Natural Color Photograph by Fred Payne Clatworthy

THE GLASS OF FASHION IN HOPI LAND

Few of the North American Indians attained as high a degree of civilization as did the cliff-dwelling tribes of the Southwest. Among these are the Hopi, a peace-loving people who are industrious, quick to learn, and have a well-developed sense of artistry. The blanket, beads, and silver belt worn by this brave are examples of their craftsmanship.



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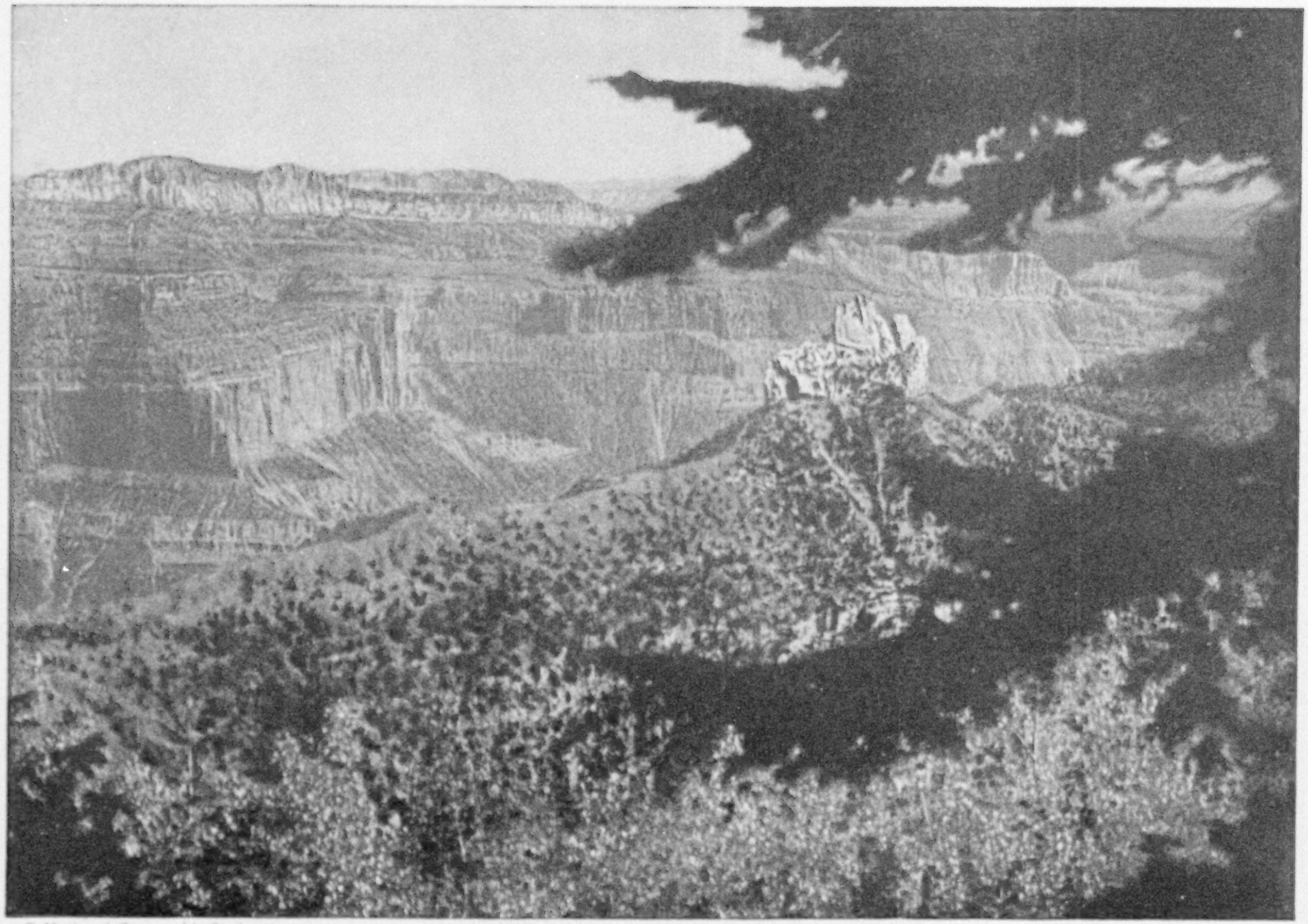
Natural Color Photograph by Fred Payne Clatworthy

ANCIENT EVERGREENS FRAME A GLORIOUS VIEW OF THE GRAND CANYON

Probably the first white men to see the glories of the Grand Canyon were Francisco de Coronado's band of Spanish adventurers, who chanced upon it about the middle of the 16th century while seeking the gold of the Seven Cities of Cíbola.



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Natural Color Photograph by Fred Payne Clatworthy

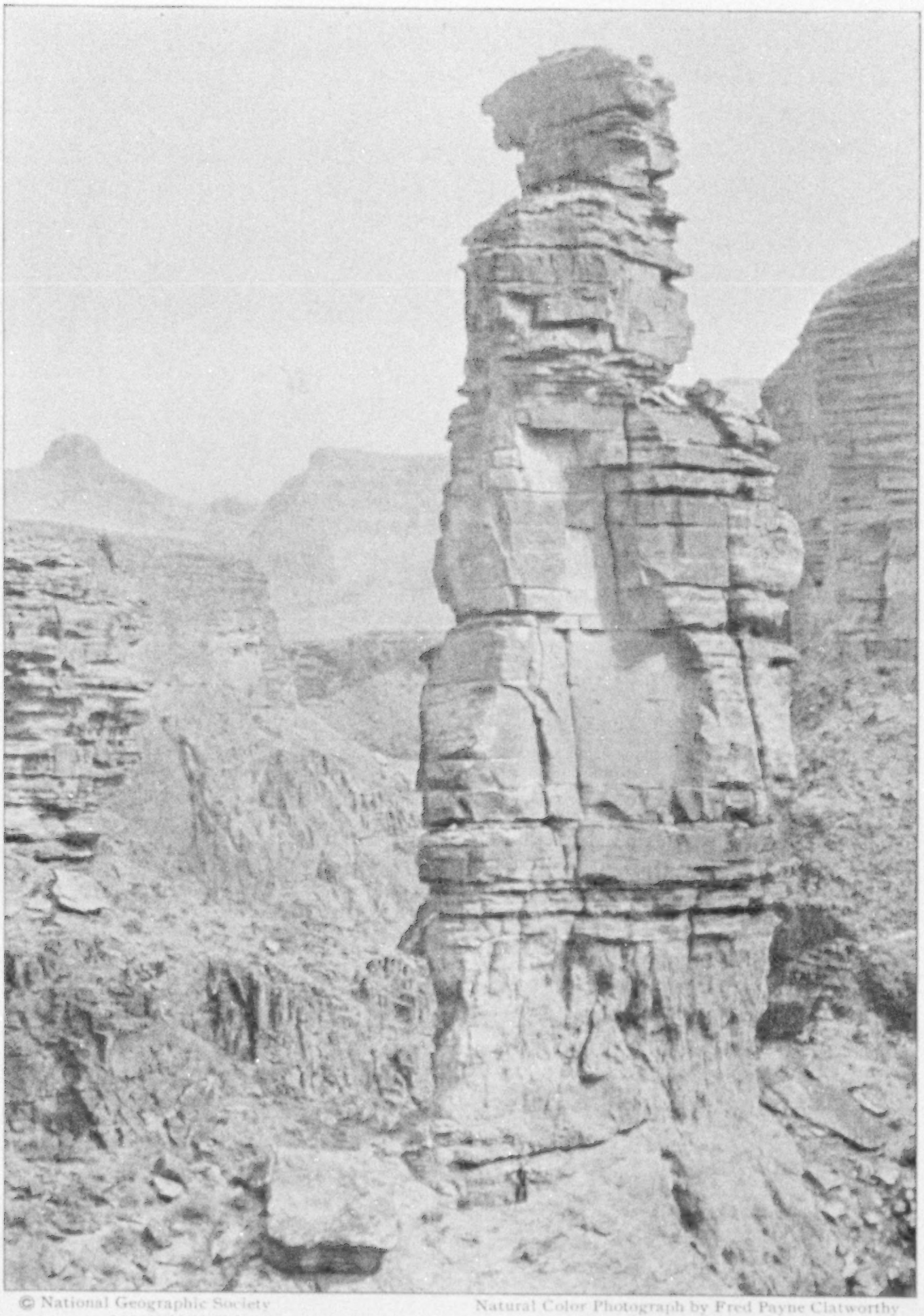
A MASTERPIECE OF THE GREAT ARCHITECT OF CREATION

More than 150,000 visitors come each year to stand in awe at this, one of the Seven Wonders of the Natural World, which has been set aside as a national park. The Grand Canyon is 220 miles long and in places is twelve miles wide at the surface, while the Colorado River, flowing at a depth of more than a mile, averages 300 feet in width. So mild is the climate at the bottom of the canyon that flowers bloom summer and winter.

© National Geographic Society Natural Color Photograph by Fred Payne Clatworthy

WHERE ROCKS AND RIVER HAVE BATTLED THROUGH THE AGES

Here the wild waters of the Colorado have carved from the rocks a Cyclopean labyrinth. The river has cut its channel to a depth of nearly 6,000 feet from the Canyon's rim and is still waging its warfare with the Earth's crust.



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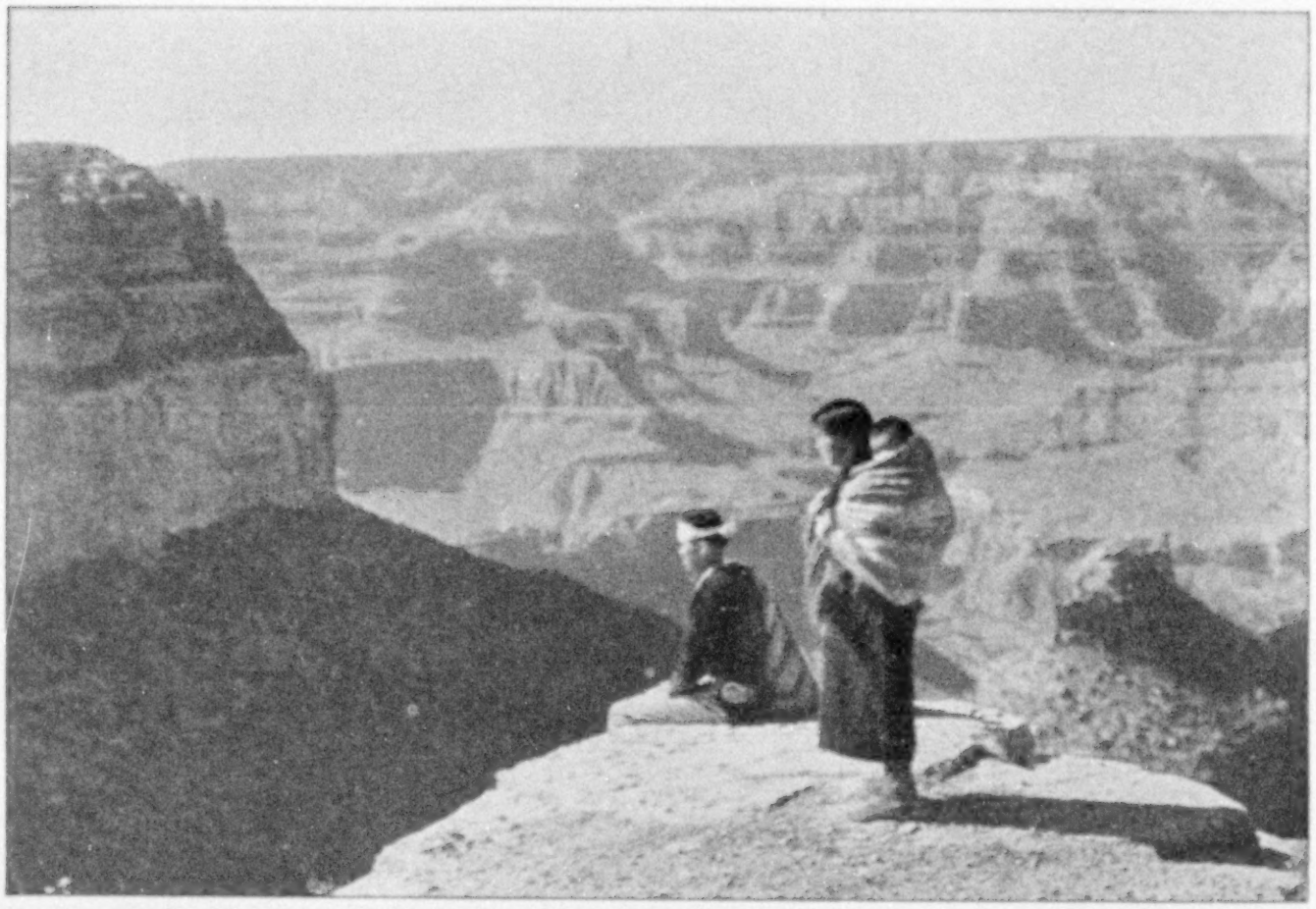
MONUMENT ROCK, A TOWERING SENTINEL BESIDE THE TONTO TRAIL

This gigantic finger of red sandstone was fashioned by wind and time's erosion. The Tonto Trail, a byway of the Grand Canyon, winds deviously along its southern cliffs, dipping here and there almost to the level of the river.



WHENCE MAN CAME TO DWELL UPON EARTH

According to Hopi legend, the first human beings arrived from the Underworld by way of the Grand Canyon.

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A SUMMER DAY ON THE CONTINENTAL DIVIDE

Although the picture was taken on June 23, there were still eighteen feet of snow along the sides of this road in Rocky Mountain National Park. Charges of T. N. T. are so placed in autumn that they may be exploded in the spring to loosen the packed snow. Without these explosives and a steam shovel to clear a way, some of the roads would be impassable until late summer.

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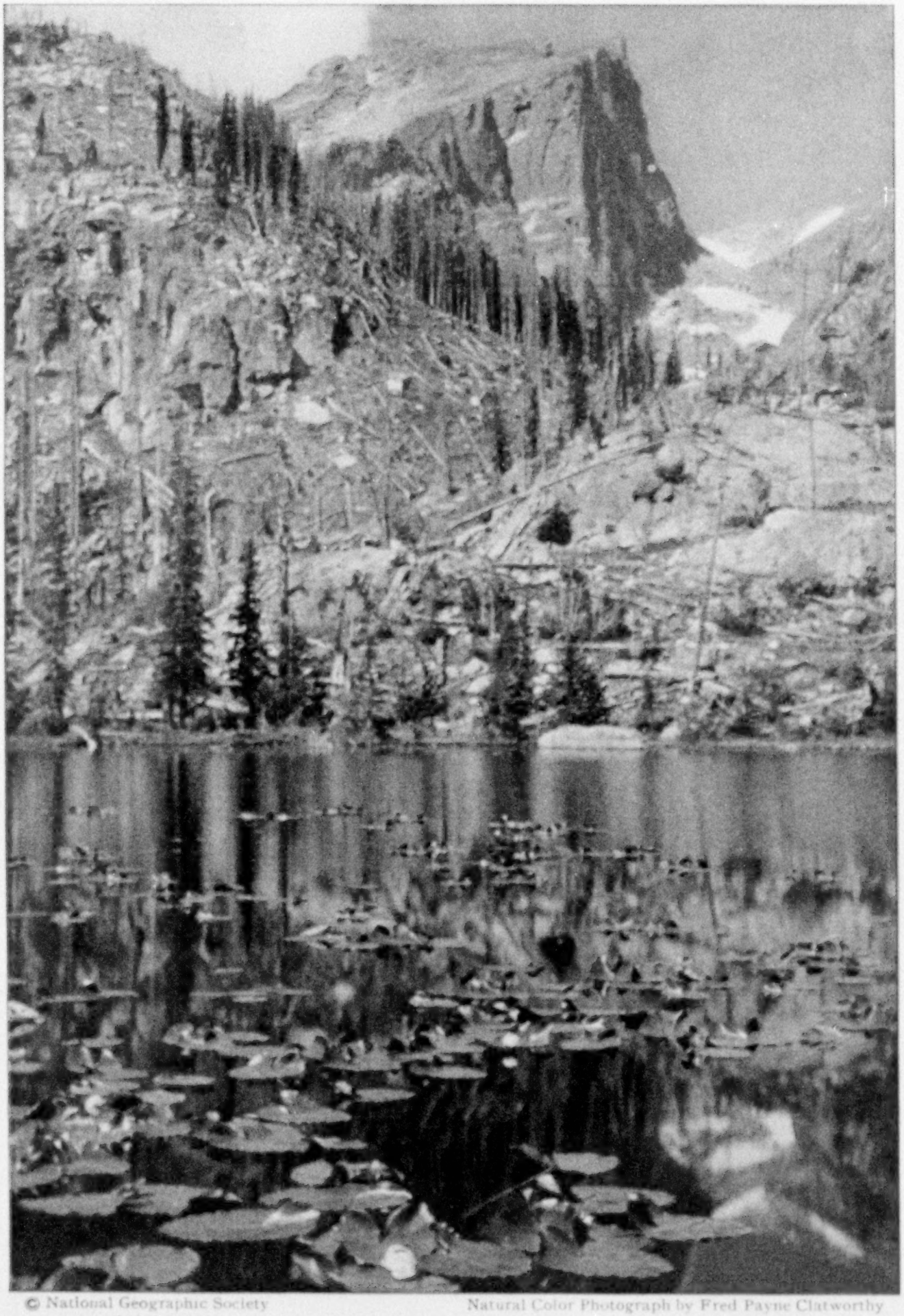
SUMMER FLOWERS ENCROACH ON WINTER'S MELTING SNOWS

More than a thousand varieties of wild flowers lend color to the ledges, slopes and fields of Rocky Mountain National Park, while a few hardy species adorn the tops of the highest peaks. The attractions of the park run the gamut of rugged mountain scenery, forests, canyons, glaciers, lakes, waterfalls and alpine meadows.



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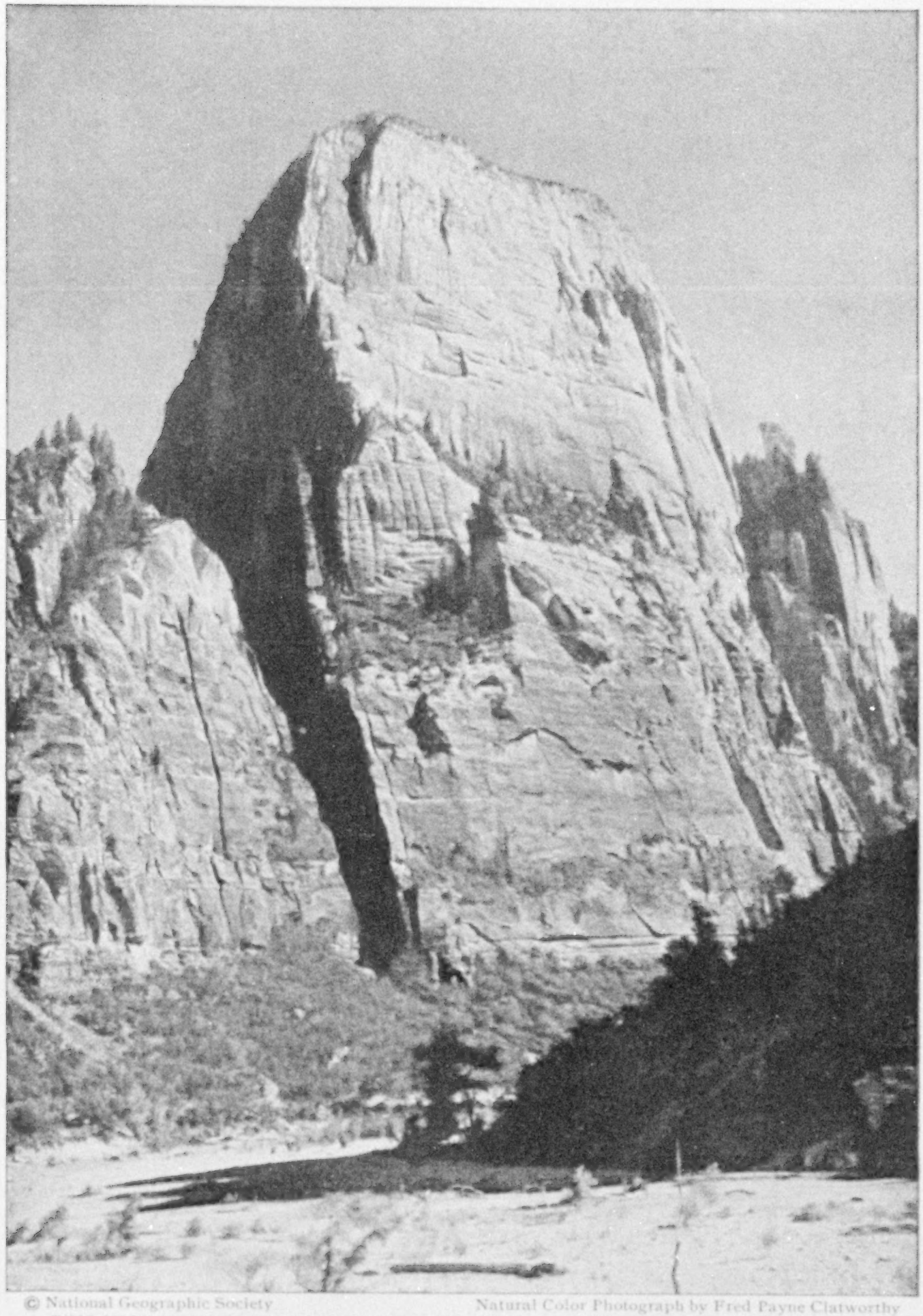
LILY-SPANGLED NYMPH LAKE IS A PRODUCT OF MOUNTAIN GLACIERS

A much-traveled trail leads along this shore to the better known Dream and Emerald Lakes. Hallett Peak, in the background, is one of fifty within the boundaries of the Rocky Mountain National Park which rise to a height of more than 10,000 feet. The park is situated in the very heart of the Rockies, yet is easily accessible both from Denver and Cheyenne.



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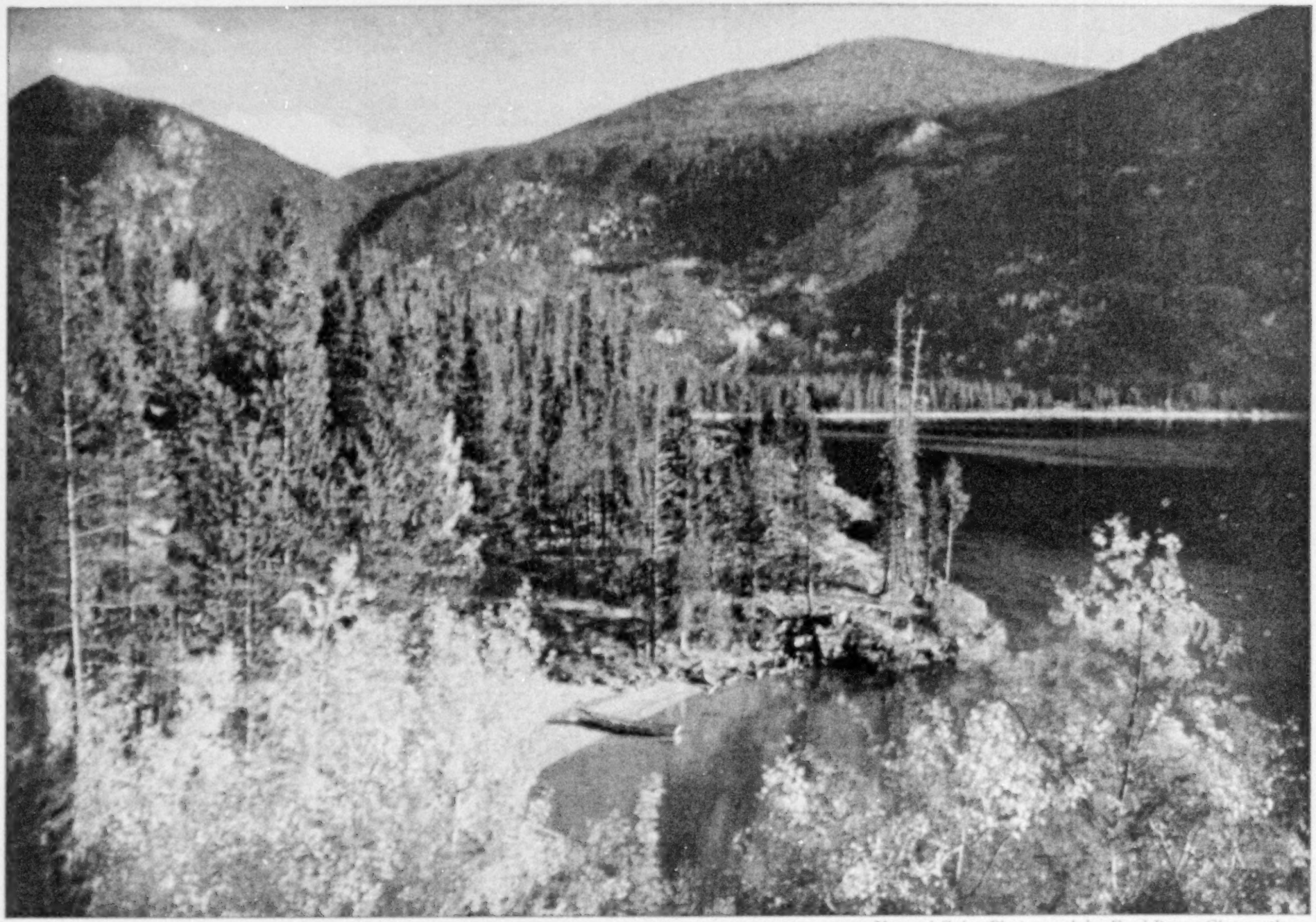
THIS MIGHTY MONOLITH REARS ITS MASSIVE BULK 3,000 FEET ABOVE THE VALLEY

The most stupendous spectacle of Zion Canyon is known both as "The Great White Throne" and as "El Gobernador." The upper portion of the vast cone of sandstone is almost white, while the lower sections shade into magnificent pinks and lavenders. So precipitous is its ascent that no human foot has ever been known to tread its timbered summit.



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THE SAPPHIRE WATERS OF GRAND LAKE NESTLE HIGH AMONG THE ROCKIES

The largest natural lake in Colorado is associated in Indian tradition with tragedy. According to the story of the Rednen, a party of Utes who made their summer home on these shores long before the white man came, were surprised and massacred by marauding Cheyennes and Arapahoes. Just before the battle all the Ute squaws and papooses were placed on a raft and sent out on the lake for safety, but a squall capsized their craft and all perished. To this day the Utes avoid the vicinity of Grand Lake.

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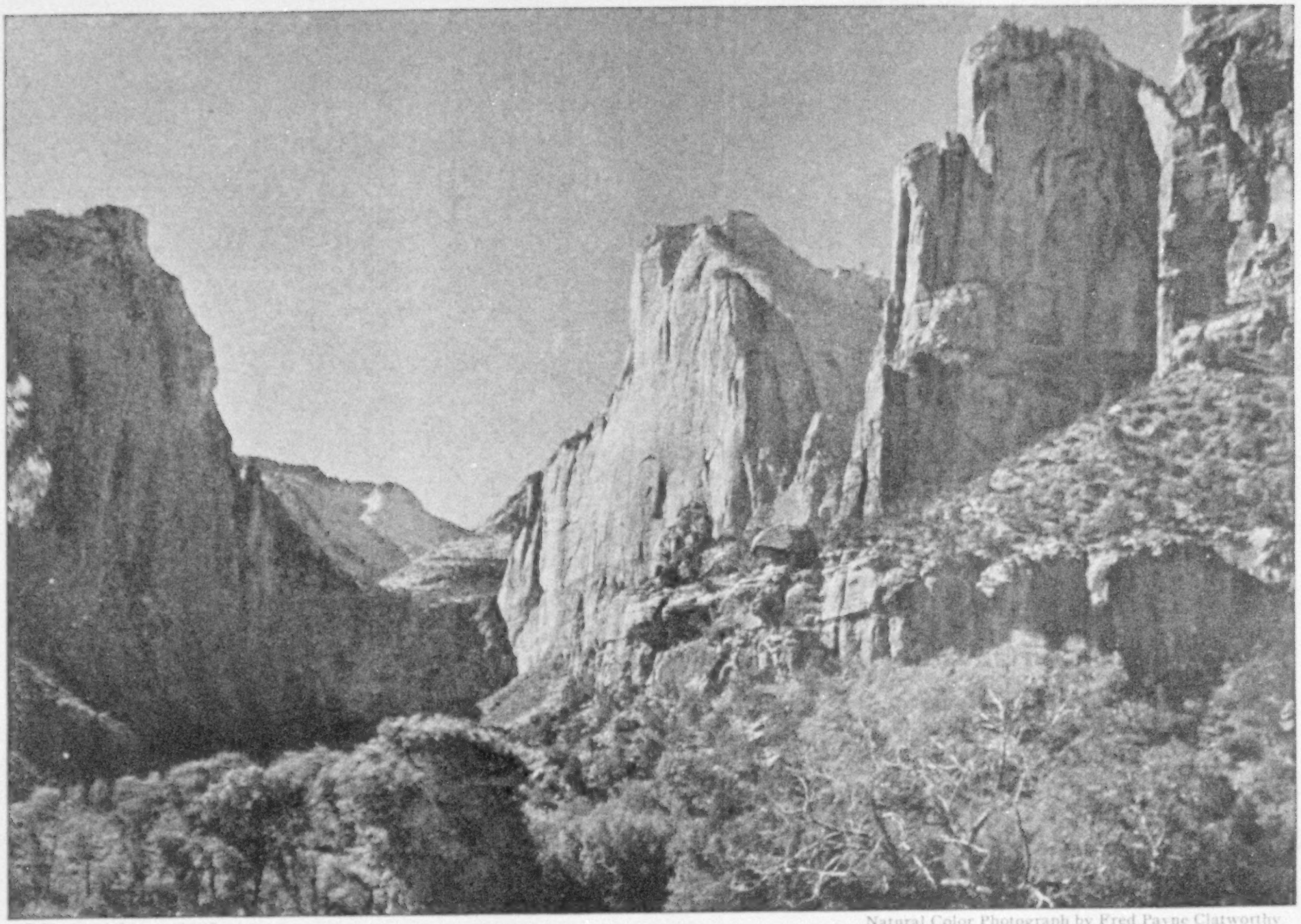
Natural Color Photograph by Fred Payne Clatworthy

A NATURAL MIRROR REFLECTS THE LOFTY MASS OF THE ANGELS LANDING

Only slightly less noble in proportion than El Gobernador (see Color Plate IX), the Angels Landing stands where a bend of the Mukuntuweap River provides a still and unruffled backwater to reflect its image. The Indians of this region will not stay in the gorge of the Mukuntuweap (Zion Canyon) at night, as they believe it to be the abode of powerful spirits who would resent such intrusion after dark.



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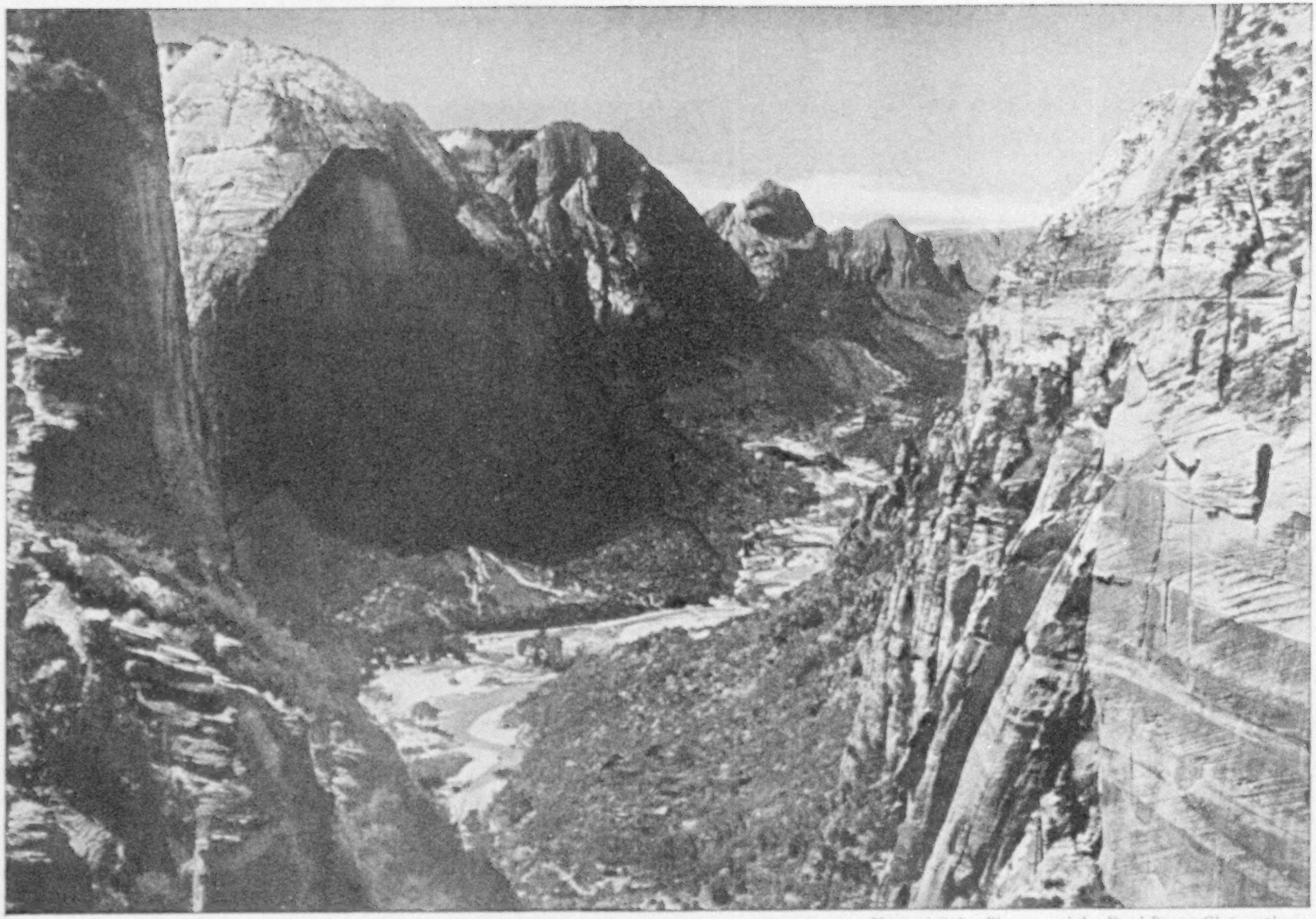
IN THE VALLEY OF THE PATRIARCHS

Zion Canyon was named by the Mormons of a former generation, who selected it as a place of possible refuge in the event they should find it necessary to flee from their settlement near the shores of Great Salt Lake. Their religious turn of mind is reflected in many of the place names within the canyon and is probably responsible for the appellation applied to these three peaks—the Patriarchs.



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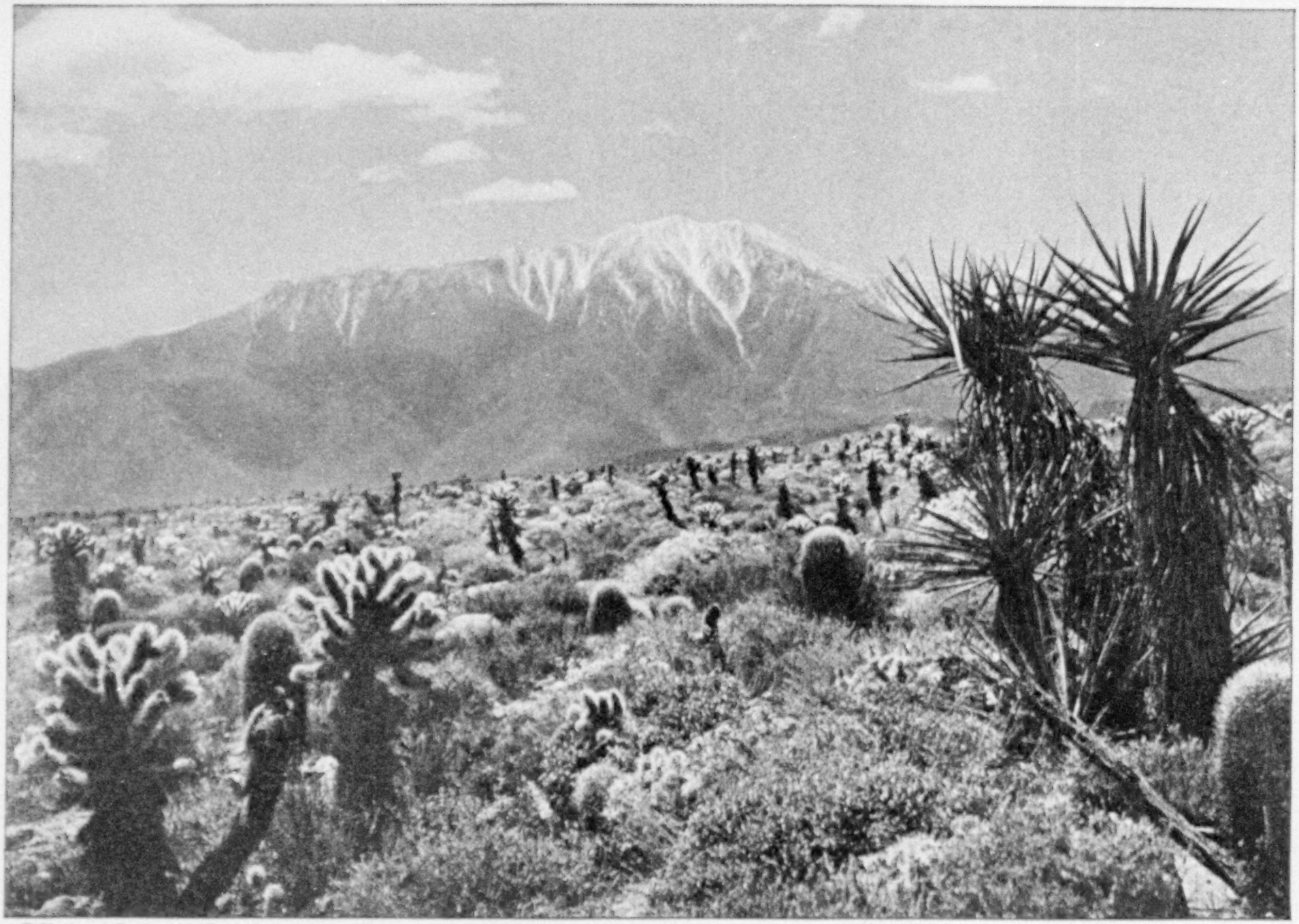
Natural Color Photograph by Fred Payne Clatworthy

ZION PARK LIES LIKE A PALETTE OF BRILLIANT COLORS AMID THE DESERT'S TAWNY SANDS

Improved transportation facilities now make it possible for many thousands of visitors to enjoy this natural art gallery each year. From the west rim of the canyon one may obtain a comprehensive view of the vast "New Jerusalem," with all its inspiring array of courts and columns, towers and thrones.



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Natural Color Photograph by Fred Payne Clatworthy

SAN JACINTO'S ICE-CAPPED HEIGHT LOOKS DOWN ON THE DEVIL'S GARDEN

The north side of the 10,805-foot mountain is very steep, rising at one point 4,300 feet in a single mile. A veritable California garden of cacti and other desert plants lies at its base. The tall palmlike plants at the right are yuccas, while in the left foreground are two of the unsavory cholla cactus, with sharp, barbed spines which, according to Indian tradition, the plants can cast at the passer-by.

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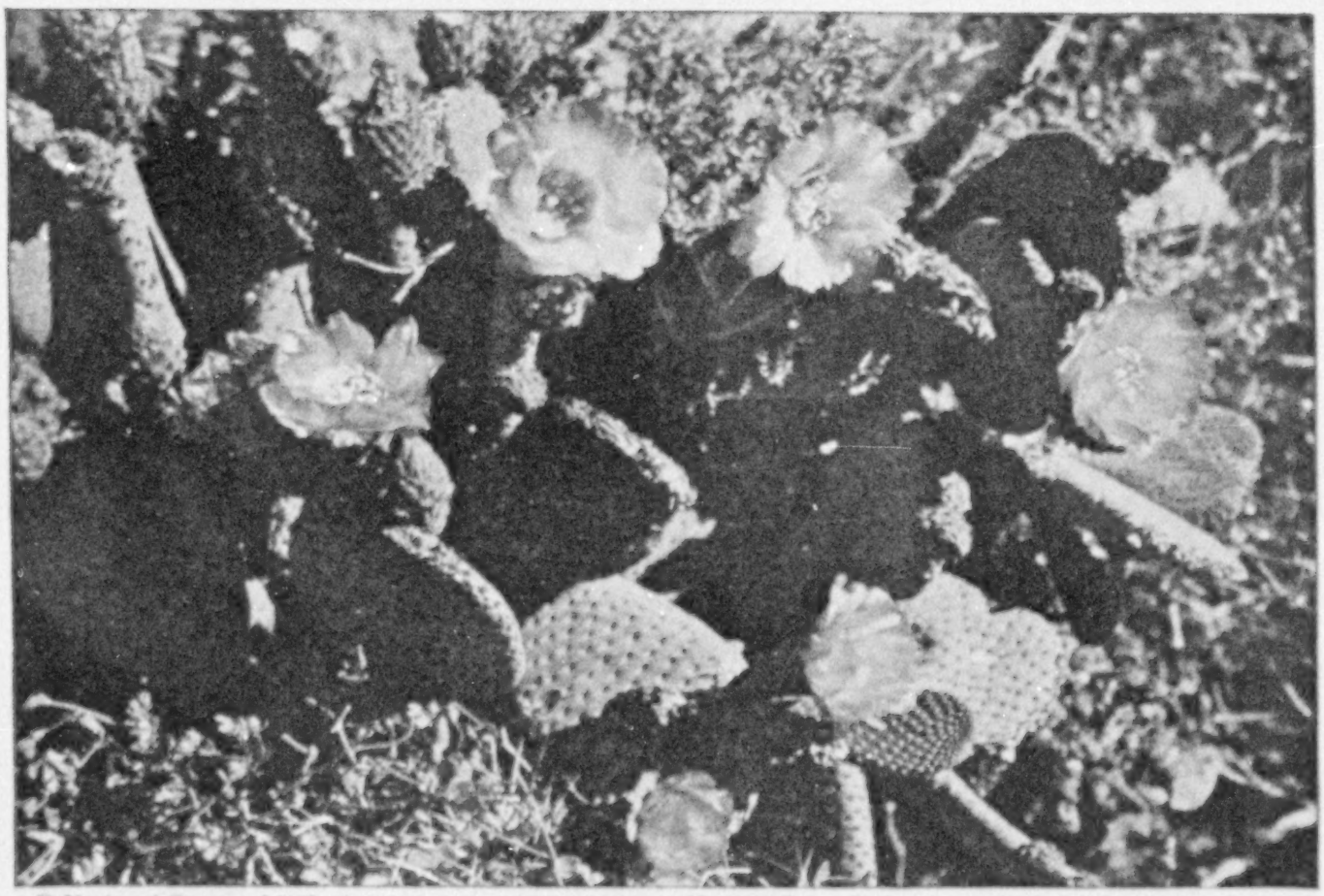
Natural Color Photograph by Fred Payne Clatworthy

SPRING SPREADS A MANTLE OF BLOSSOMS OVER SOUTHERN CALIFORNIA

The gold which attracts visitors to the Pacific coast to-day is not the same kind that started the rush of the Forty-niners. The modern attraction is a climate which early in spring causes the fields to burst into a kaleidoscope of wild flowers.

FLORAL AMETHYSTS IN A PRICKLY SETTING

The drabness of the desert is dispelled when the cactus blooms, for its flowers rival the orchid in beauty of color and delicacy of texture.



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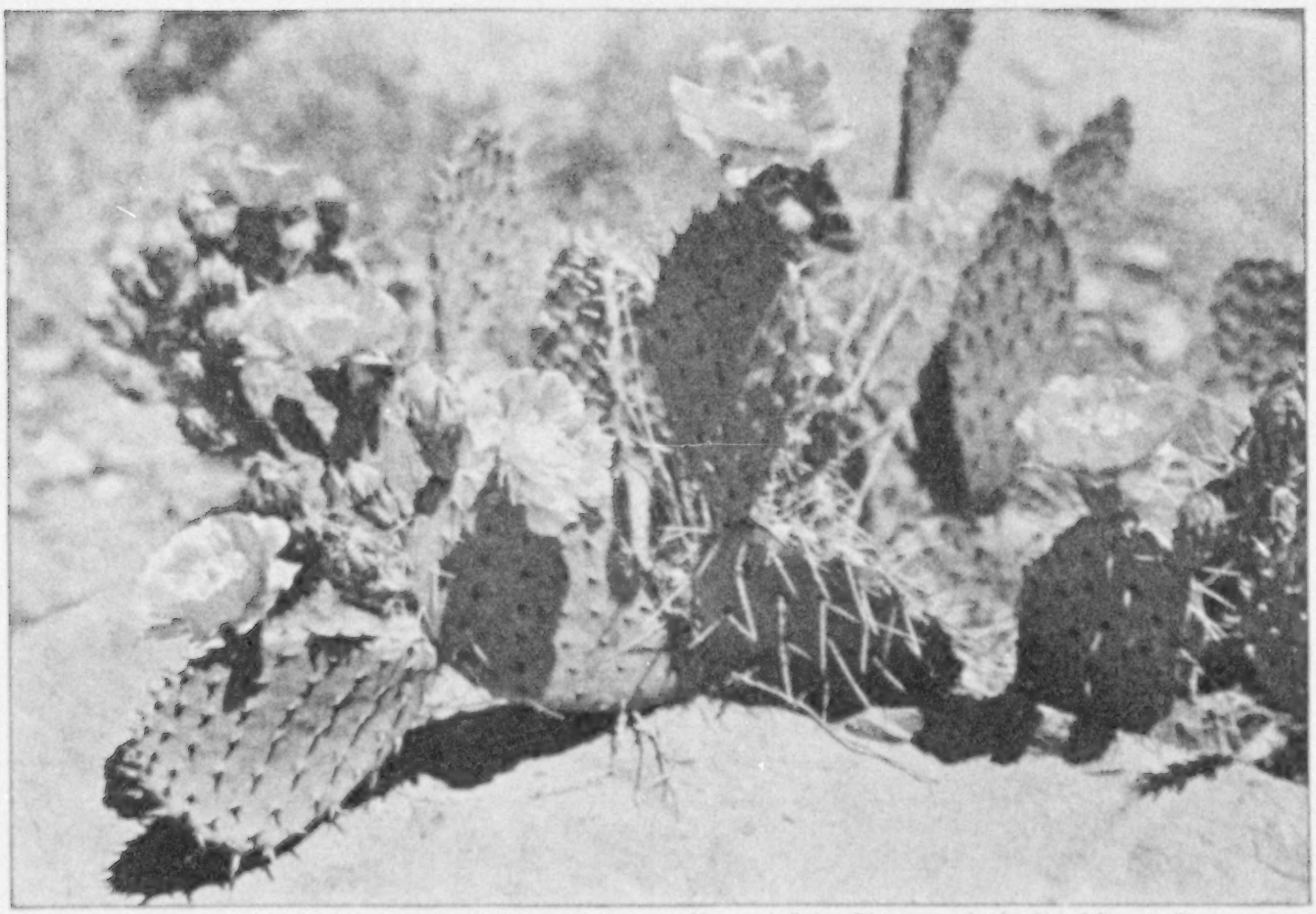
BLOSSOMS OF THE FAN-LEAF CACTUS REFLECT THE DESERT DAWN

Some of the cacti which are insufficiently protected by the customary spiny armor are so full of tannin that most animals refrain from taking a second nibble.

A PORCUPINE'S COUNTERPART IN THE PLANT WORLD

The flowers of the hedgehog cactus are two or three inches long and spring from a cucumberlike stem plentifully besprinkled with spines.



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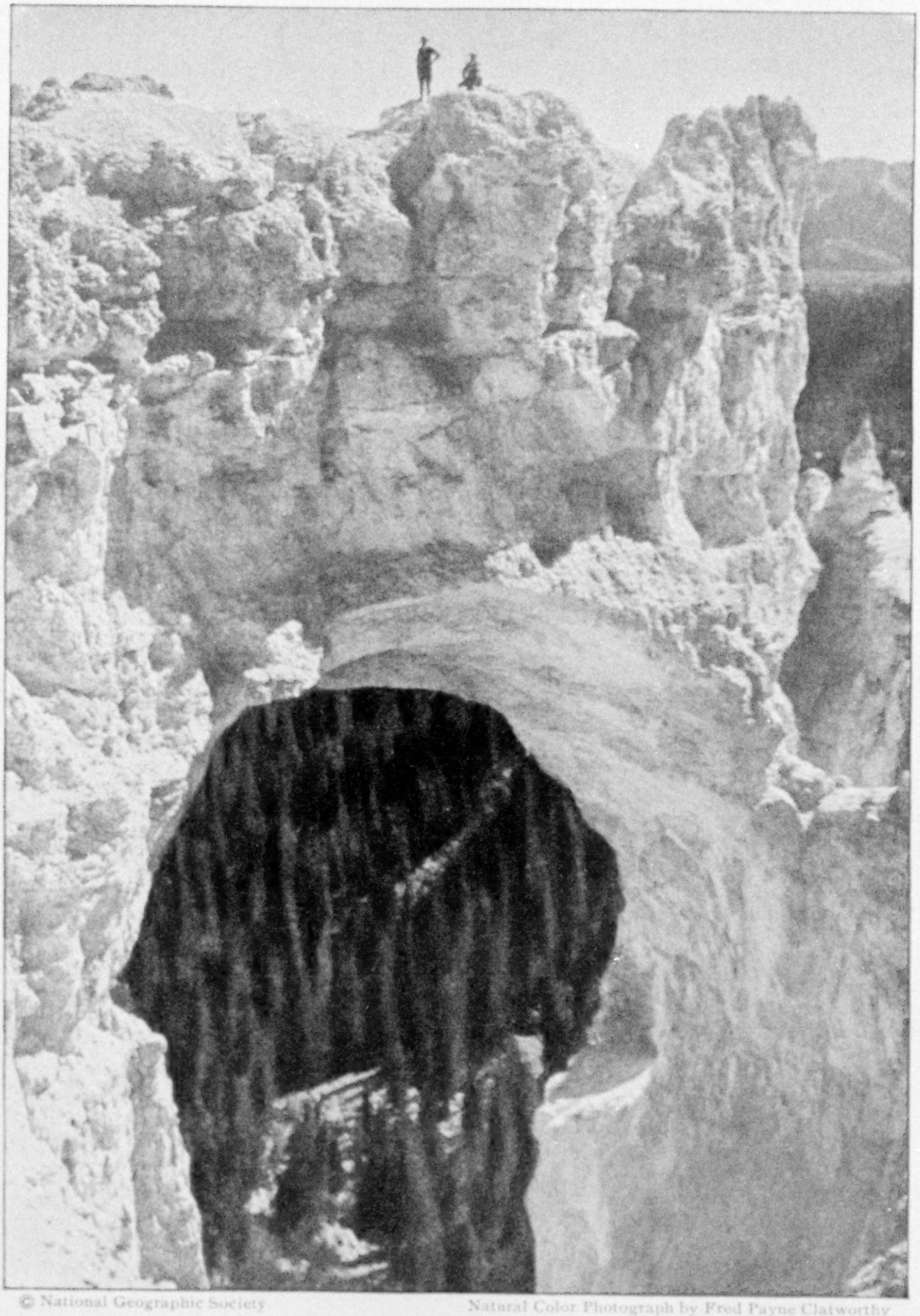
JEWELS AND THORNS ALIKE ADORN THE DESERT'S CROWN

More than fifty varieties of the prickly pear cactus are found on the American deserts. They are usually distinguished by yellow or orange flowers and long spines.



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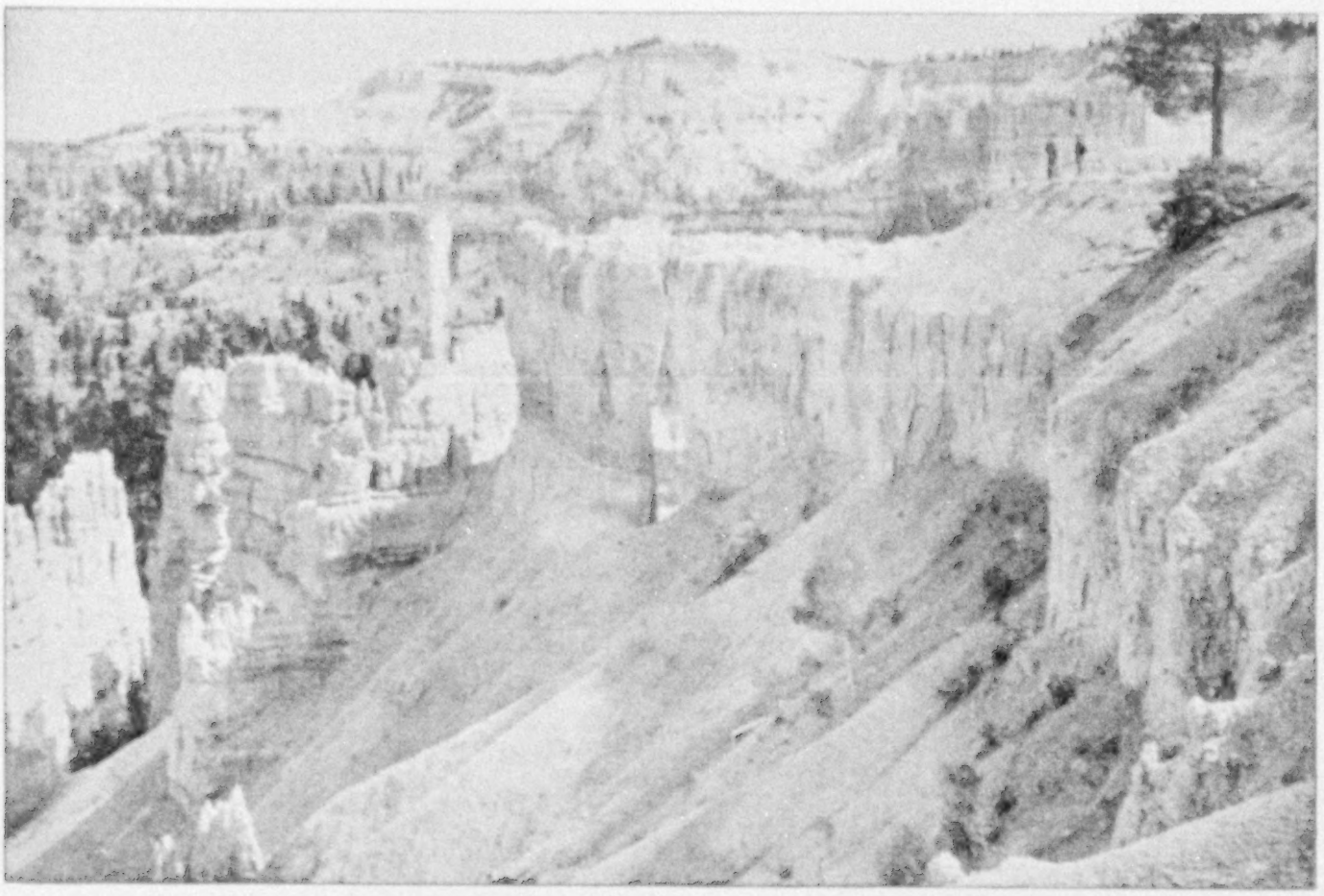
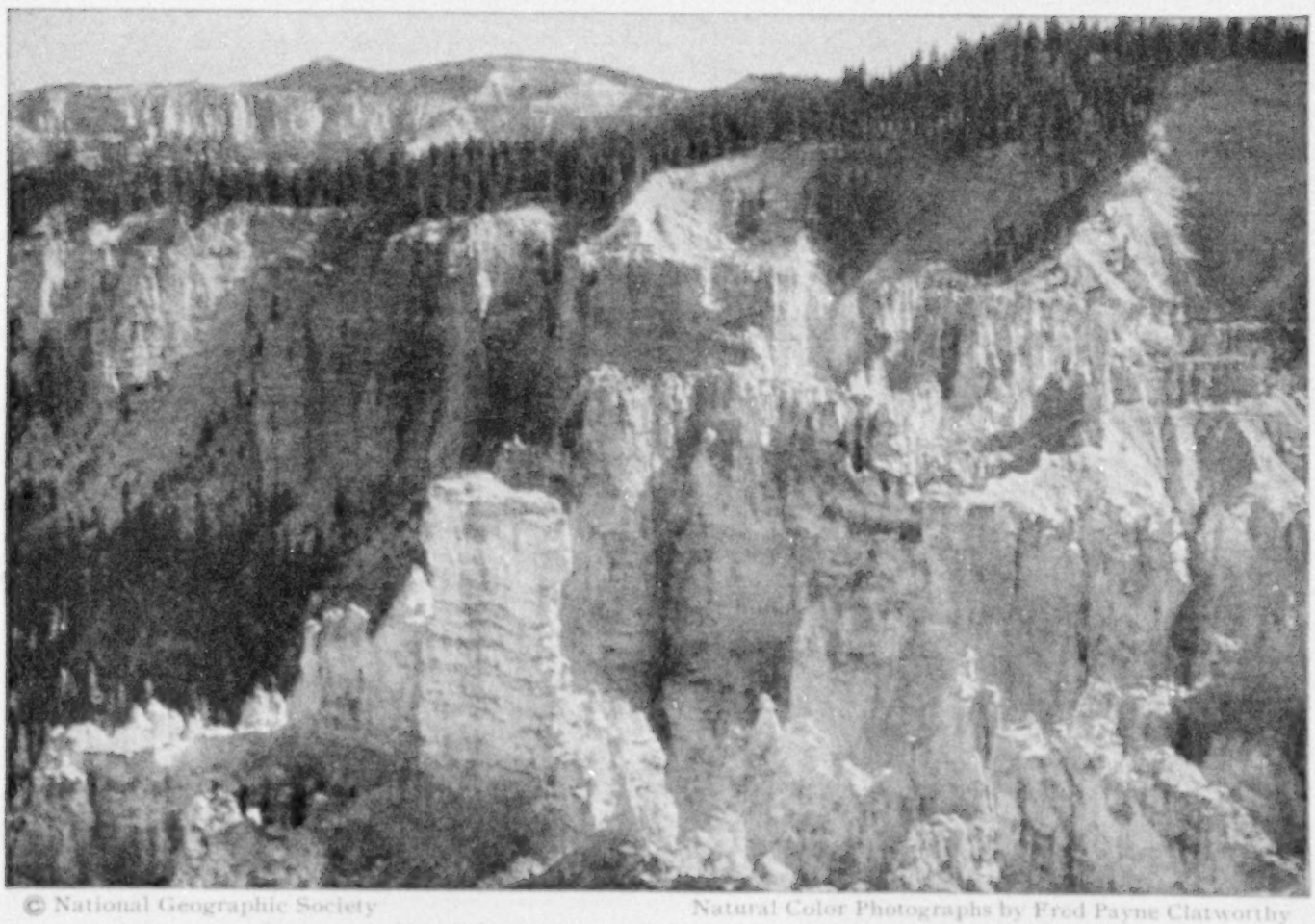
A NOBLE SPAN WROUGHT BY WIND AND WATER

The natural bridge some ten miles south of Bryce Canyon, while not the largest in America, can lay legitimate claim to being among the most beautiful in color. Its arch is approximately 100 feet high.



BRYCE CANYON IN SOUTHERN UTAH, VIEWED FROM THE RIM

The chasm discloses a vision of fairylike, filigreed lacework of stone, suffused with colors of endless variety.



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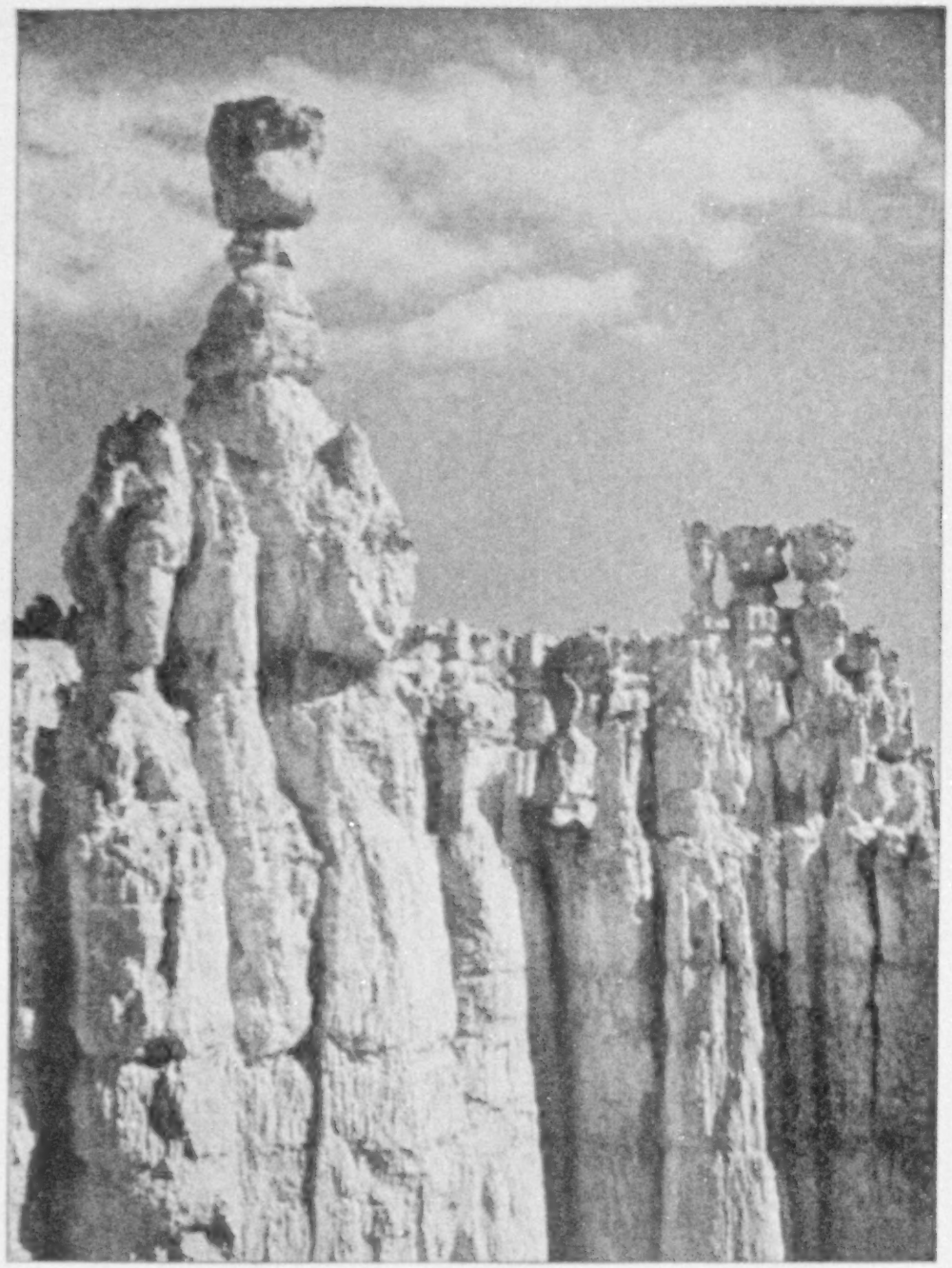
UTAH'S CANYONS RIVAL THE RAINBOW

So stupendous are the dimensions of these Western wonderlands that one loses all sense of proportion. The pink stone mass in the foreground is about the size of New York's famous Flatiron Building.



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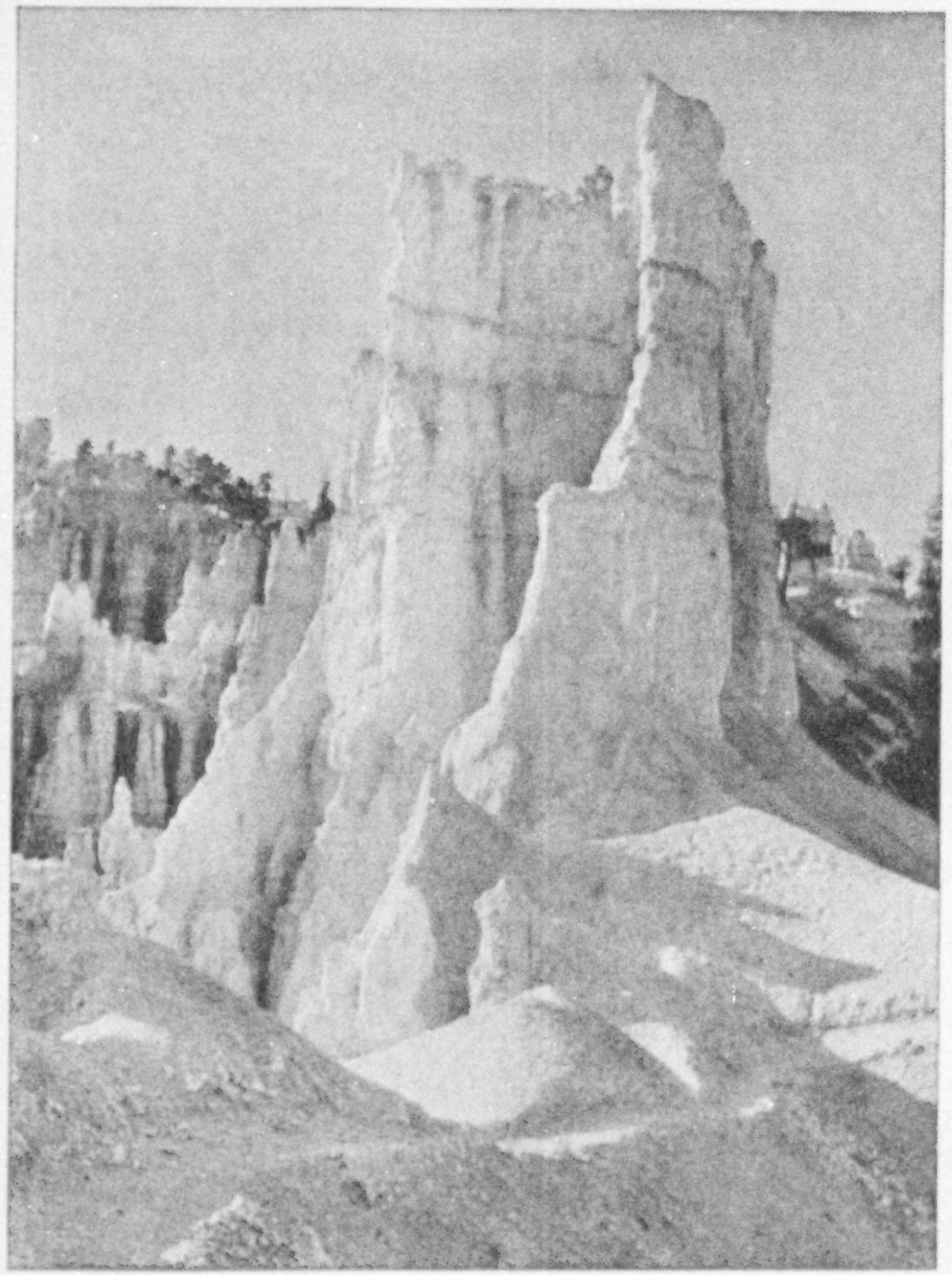
GIGANTIC TULIPS ON STEMS OF STONE

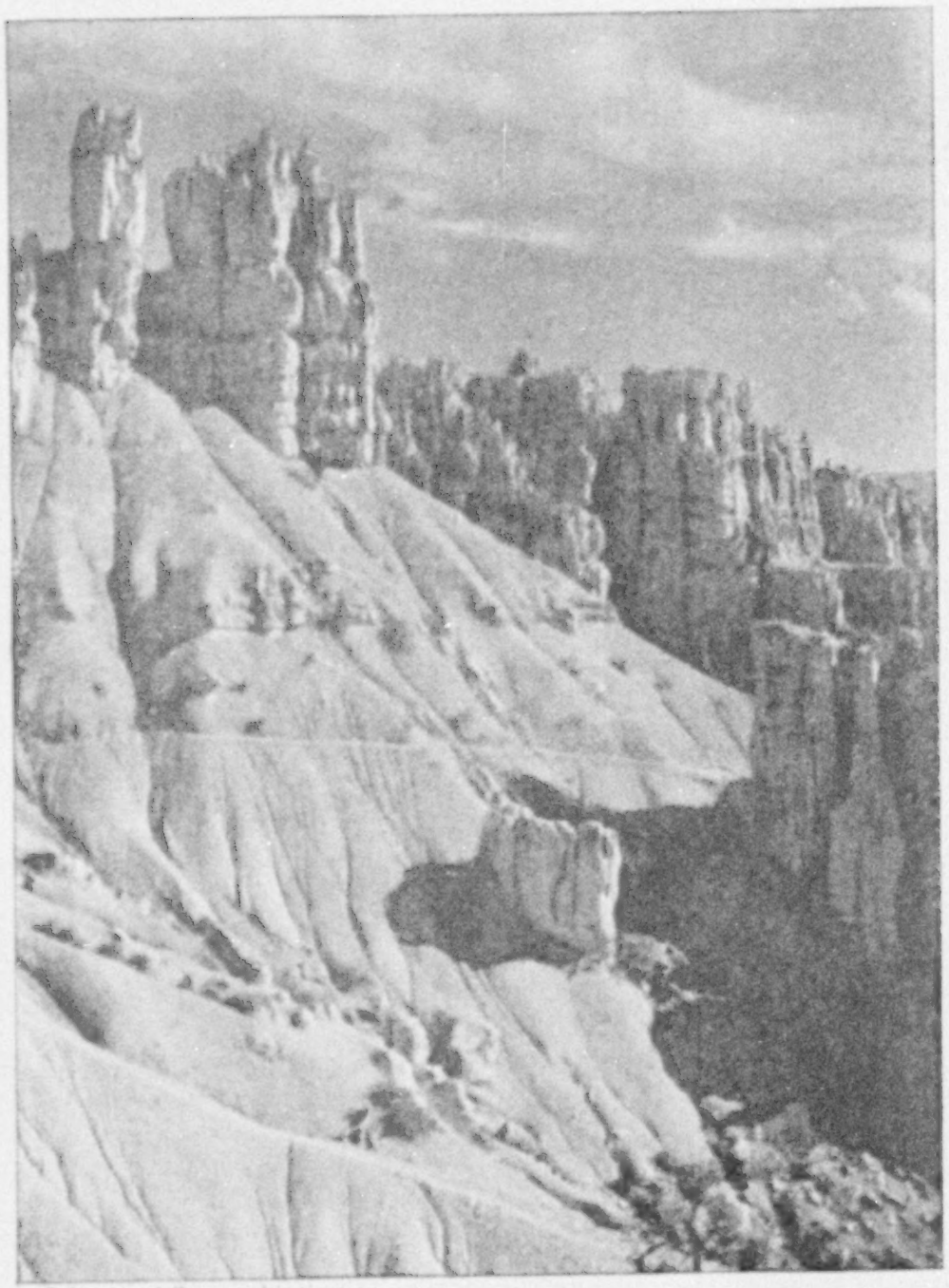
Nature has wrought grotesque figures of men, animals, trees, flowers, towers and temples in the rocks of Bryce Canyon.



Natural Color Photographs by Fred Payne Clatworthy

THE THRONE OF SOME TITANIC MAJESTY

A king who could sit comfortably on such a throne would have to be 200 feet tall.



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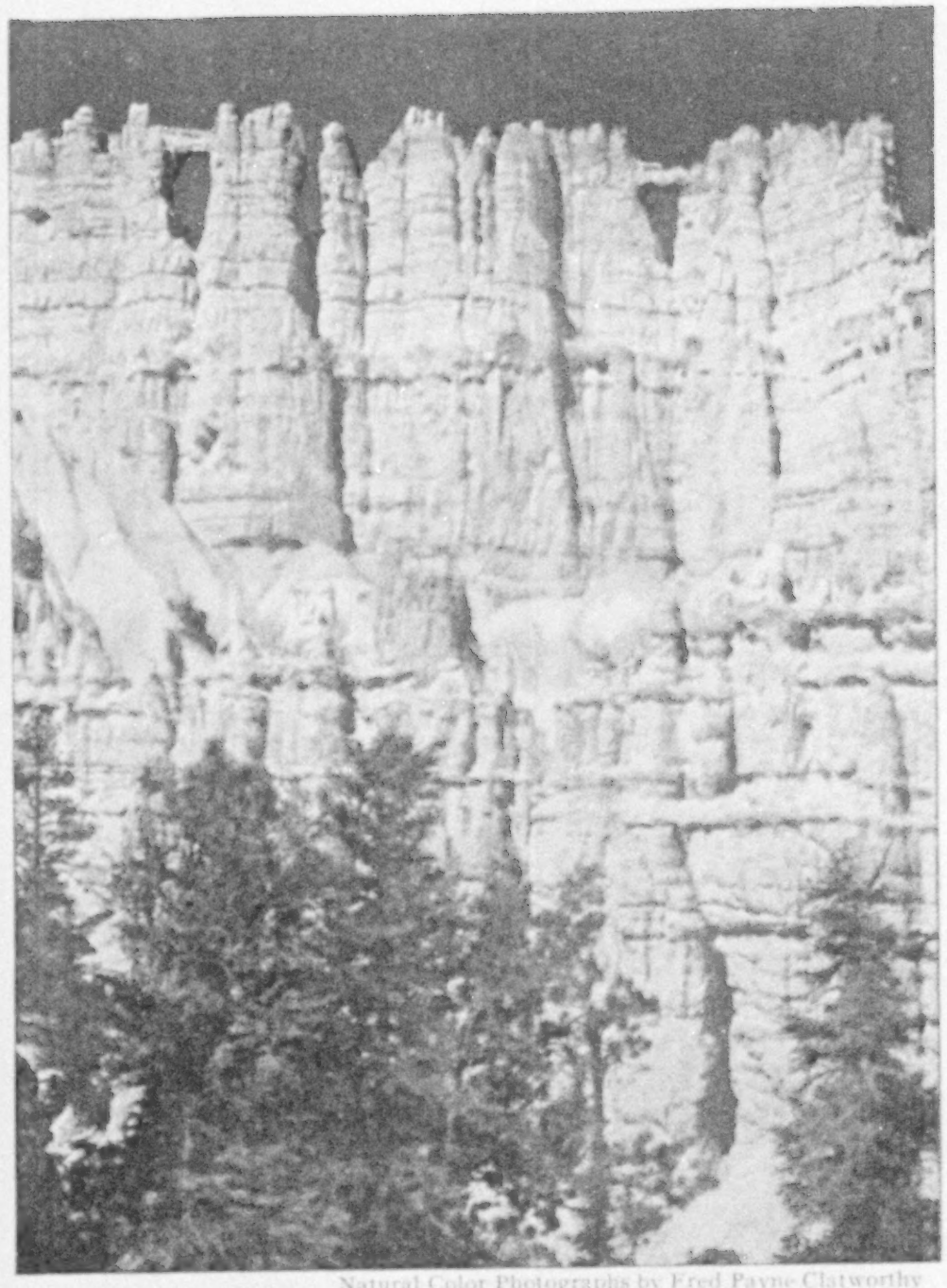
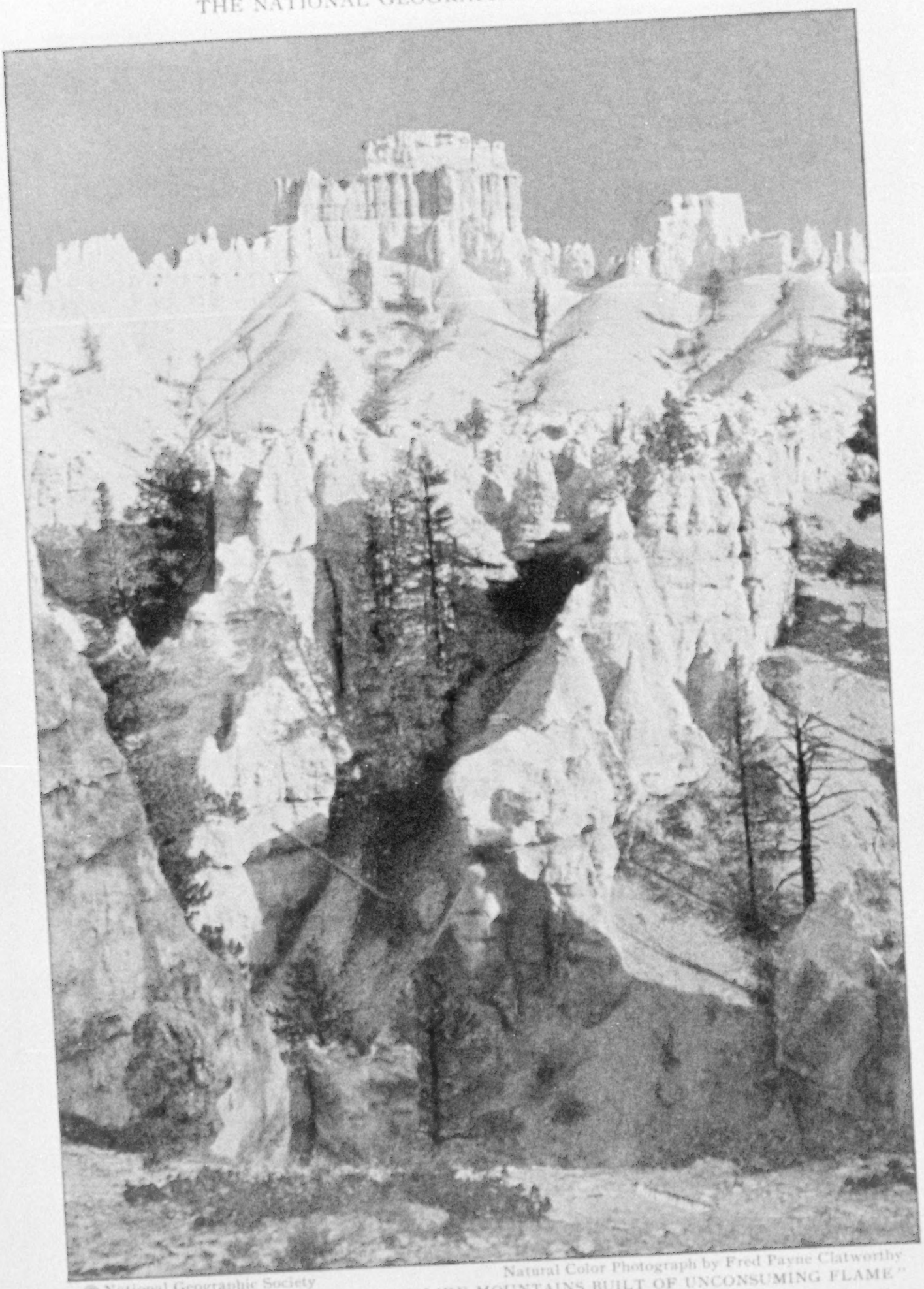


Natural Color Photographs by Fred Payne Clatworthy

WORKS OF THE MASTER CRAFTSMEN OF EROSION

The forces of Nature have been at work in Bryce Canyon for countless æons and have carved multitudinous monuments from its sandstone walls. The formation at the right is known as the "Wall of Windows." Several of the apertures are high enough to accommodate comfortably a six-story building.



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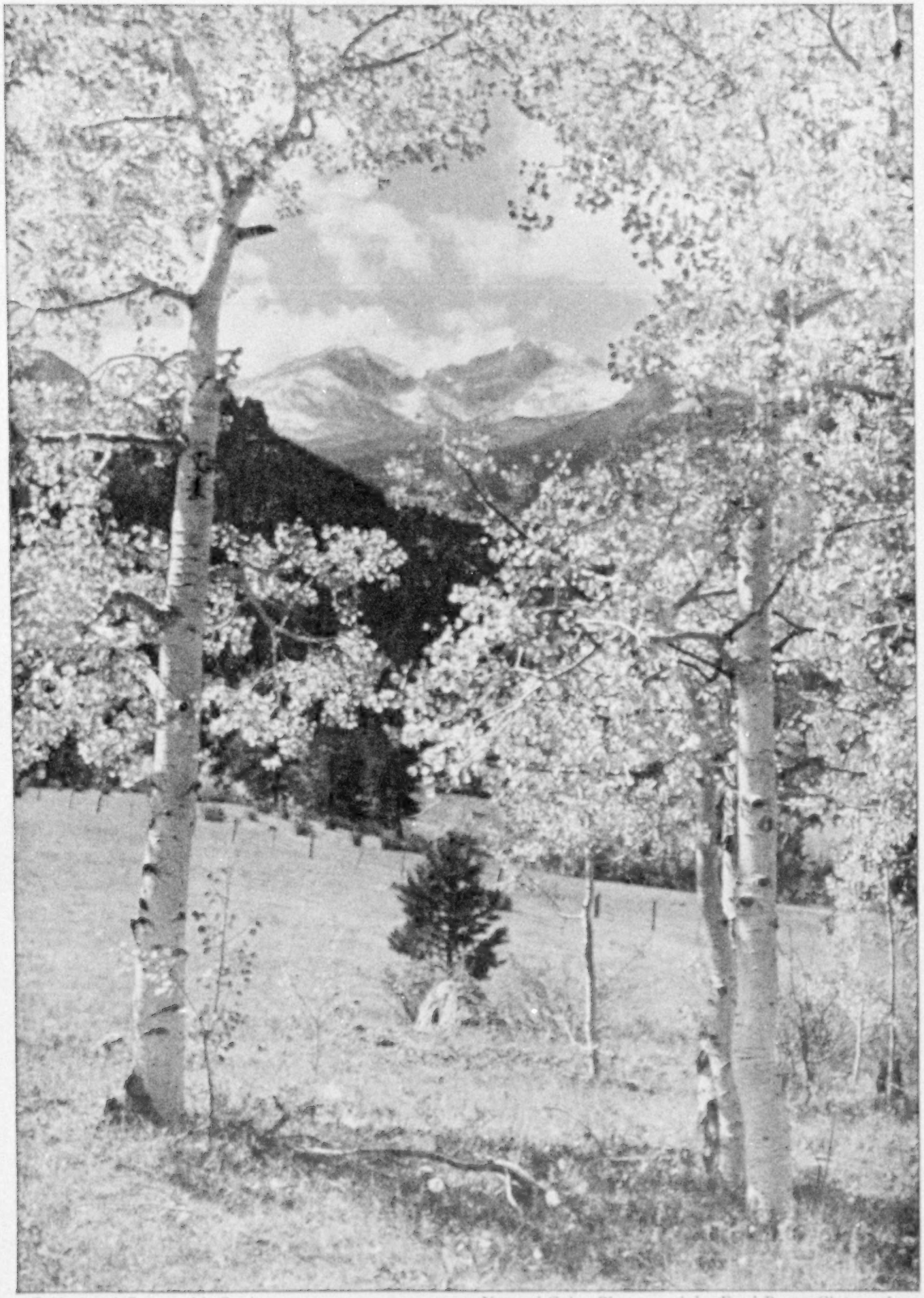
Natural Color Photograph by Fred Payne Clatworthy

"AND HUGE AERIAL PALACES ARISE, LIKE MOUNTAINS BUILT OF UNCONSUMING FLAME"

The views in Bryce Canyon appear like vistas in a dream city of some long gone and forgotten race. Many of its strange and fantastic formations are graven from a rock as white as pure Carrara, while others reflect the soft rose pink of the sunset glow.



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LONGS PEAK IS THE MONARCH OF ROCKY MOUNTAIN NATIONAL PARK

The 14,255-foot summit was first attained in 1868 and its ascent has since become one of the favorite expeditions of America's aspiring amateur mountain climbers. Several beautiful snow-born streams flowing from Longs Peak have carved canyons in the vicinity.

© National Geographic Society Natural Color Photograph by Fred Payne Clatworthy

THE SIOUX WERE ONCE LORDS OF THE WEST

No other tribe resisted the oncoming tide of the white man's civilization with more determination than the brave and aggressive Sioux. A well-equipped people, both physically and mentally, they were for many years monarchs of the country that is now Minnesota, the Dakotas, and Montana. The ancestors of some of the chiefs pictured here planned and executed the campaign in which Custer's immortal band perished.

color pictures in the NATIONAL GEOGRAPHIC MAGAZINE, realize the great difficulty experienced in securing the originals. Natural-color plates mark the greatest advance in photography in fifty years; but color photography is still in its infancy. Not only does it require from 60 to 100 times the length of exposure of an ordinary photographic plate, precluding all motion work, but the fact that the plate is sensitive to all colors, red included, makes it extremely difficult to handle.

The color pictures in this issue represent many weeks of tramping along canyon rims and exploring canyon depths, and thousands of miles of travel over mountain ranges and across inhospitable desert wastes, during a period of many years, to discover suitable subjects.

The Grand Canyon of Arizona has been visited many times since my first trip, thirty years ago. I have camped beside the muddy Colorado at its bottom, walked down nearly all of its trails on both sides, followed the Tonto Trail over its plateaus, and walked hundreds of miles along its rim, from the old deserted Hance Trail on the east to the famous Bass Trail on the west (see Color Plates II, III, IV, V, and VI).

MUNCHAUSENS OF THE GRAND CANYON

Hance and Bass, it will be recalled, prided themselves on being the two greatest prevaricators that ever lived in Arizona. John Hance once said to me: "You know, there are only three real liars at the Grand Canyon; I am one of them and Bass is the other two."

Hance said he once owned a fine Arabian horse that had a record for jumping. He believed that if he could find a suitable take-off the horse could leap the Grand Canyon. Finally a trial was made. When they reached the edge, the horse made a tremendous leap, but when halfway across, the rider saw his mount wasn't going to make it; so he tried to turn around and come back, but they fell 5,000 feet, and Hance added, "Only presence of mind saved my life, for I stepped off the horse's back just before we struck the bottom."

Hance repeatedly told us not to believe the erosion theory of the formation of the canyon, for "it was all bunk"; he and his partner, years ago, dug it and dumped the dirt where the San Francisco peaks are now located.

The Great American Desert, which comprised most of the country west of Colorado in our geographies forty years ago, has shrunk in successive editions until it now occupies a comparatively small area on each side of the Colorado River, in Arizona and California, and extends north into southern Utah. No other equal area in the whole world compares with this section in varied and gorgeous colors. It is bounded on the east by the Grand Canyon and the Painted Desert country, on the north by the "flaming canyons and jeweled amphitheaters of southern Utah."

My most strenuous trip in Zion National Park was the all-day climb up the old Mormon Trail to Observation Point, on the east rim. During this trip, partly on horseback and partly on foot, we were constantly encouraged by being shown where this or that horse had slipped off into the depths below. The view of Zion from a new trail to the west rim was taken before the trail was completed and it still provided many thrills (see Color Plates IX and XI).

Bryce Temple, in a more beautifully colored environment than any Grecian temple could ever boast, is one of the outstanding formations of Bryce Canyon. The author spent an entire day securing the autochrome, walking and climbing over a dozen miles, scaling almost perpendicular ridges to obtain the most effective view, and finally, in mid-afternoon, just the viewpoint desired was attained. It happened to be the summit of a hogback, nearly 500 feet above the floor of the canyon, which had been climbed once before the same day. The camera was a half mile from the temple and some 300 feet below, with a 500-foot gorge between. After a half-hour wait for the right light, the deed was done (see Color Plate XXII).

The desert flower and cactus pictures (Color Plates XIV, XV, XVI, and XVII) are the results of a thousand miles of rambles afoot and by camp car, up and down the Colorado and Mohave deserts, with Palm Springs, that incomparable oasis in the desert, as a base. During one of these picture trips I nearly lost my life in a Death Valley sandstorm. The man just behind me was smothered to death.

The Rocky Mountain National Park pictures (Color Plates VI, VII, and VIII) represent years of exploration of its most inaccessible canyons, lakes, and forests.

Photograph by Capt. Albert W. Stevens

THE POCKMARK ON THE FACE OF THE ARIZONA DESERT

Nothing like Meteor Crater has been discovered anywhere else on the face of the earth. Until recently no meteorite has been known to penetrate more than eleven feet into the surface of the earth. On the morning of July 30, 1908, natives of north-central Siberia saw a fiery body shooting across the sky and heard, a short time later, a thundering detonation. A Russian scientist succeeded only last year in locating, in the Yeniseisk district, a place where the forest had been blown down over an area 30 miles in diameter. At the center of devastation were many pits indicating the tombs of a number of large meteorites, but no holes comparable to Meteor Crater. An expedition has been organized to dig out the Yeniseisk meteorites.

THE MYSTERIOUS TOMB OF A GIANT METEORITE

By William D. Boutwell

TO POSSESS a wonder of the world — the Grand Canyon, the Falls of the Zambezi, the Taj Mahal, or the Pyramids—is a proud estate for any nation. To possess a wonder from beyond the world is a still rarer privilege, although it meets with less acclaim.

In the Cape York meteorite, brought back from north Greenland by Rear Admiral Robert E. Peary, the United States has the largest single object known to have reached the earth from the heavens. To this meteorite can be added another remarkable prize legacy of the skies within the borders of the United States—the largest known tomb of a meteorite. The tomb gives evidence that a mass of metal thousands of times larger than the Cape York meteorite dropped from the skies near Canyon Diablo, Arizona.

METEOR CRATER ATTRACTS AIRMEN

Because night overtook them, Lieutenant John A. Macready,* aviator, and Captain Albert W. Stevens,† air photographer, set down the airplane in which they were making a swing around the national parks in the West, on a dry lake bed at Winslow, near Canyon Diablo, Arizona. The inhabitants lost little time in informing them that Winslow was not just Winslow; it was Winslow, the "Meteor City." Furthermore, they learned that the unusual title was borrowed from the remarkable crater in the desert 20 miles away.

Early next morning the two flyers were off to see Meteor Crater. A few minutes' flight brought them to this astonishing hole. From the air it looked exactly like the enormously enlarged pit of a "dud" shell. The rim of white material thrown out of the cavity by the impact framed the hole against the purple and red surface sandstones that decorate the Painted Desert. Across the crater bottom the early morning sun threw a black scarf of shadow, producing a striking and significant resemblance to the stark craters that pockmark the moon.

In all the broad area visible from the plane, Meteor Crater was the most conspicuous object. It dominated the desert like a drop of ink on a blotter. Twenty miles east, columns of smoke marked the railroad yards at Winslow. Forty miles along the black etched line of the Santa Fe Railroad, in the other direction, was San Francisco Mountain, with its hood cloud and with Flagstaff nestling at its foot.

The railroad runs six miles north of Meteor Crater. Closer to the pit unrolls the taut white ribbon of the transcontinental highway, the Santa Fe Trail. Still nearer is the ragged-walled, zigzagging incision of Canyon Diablo.

Within a circle roughly described by a six-mile radius from Meteor Crater more meteoric iron has been picked up than has been found in any like area over the entire surface of the earth. Since meteorites are more significant than diamonds to the scientist, Canyon Diablo and Meteor Crater are well known to the scientific world, although they will be found on few maps.

To make a closer inspection of Meteor Crater, one must drive out or take the train as far as Sunshine Station. A boxcar forgotten by some hurrying freight is the station; there is nothing else—except sunshine.

All alone in the midst of the desert south from Sunshine Station is a mound that at first sight appears to be a flat-topped butte, characteristic of the Southwest. Surmounting the center of the "butte" is a lonely derrick (page 728).

THE CRATER IS 570 FEET DEEP

One must approach the mound, climb the half-mile slope which rises 150 feet, and actually stand on the crater rim to experience the awe this tomb inspires. The bottom of the crater is 440 feet below the natural level of the surrounding desert; 570 feet below the rim where the observer first sees the complete picture. The cliff at one's feet shelves down almost vertically until it reaches the slope of broken rock and sand torn off the walls by ero-

* Author of "The First Non-stop Flight Across America" and "Exploring the Earth's Stratosphere," in the National Geographic Magazine for July, 1924, and December, 1926, respectively.

† Author of "Exploring the Valley of the Amazon in a Hydroplane," in the National Geographic Magazine for April, 1926.

Photograph by Capt. Albert W. Stevens

AN AËRIAL VIEW OF SOUTH CAMP, AT METEOR CRATER

Men conducting recent drilling operations lived in the bunkhouses in the middle foreground. The white gash to the right shows where rain has cut a creek bed through the tons and tons of fine white rock flour pulverized by the impact. The first drilling for the meteorite was begun at the center of the pit, and the trail visible on the far side was made to bring down machinery and supplies.

sion. The sides all around are steep and ragged. A trip to the bottom, one rightly suspects, is an adventure of inverted mountain-climbing.

It is disturbing to revisualize the collision. One suddenly remembers the favorite problem of the physics teacher in high school. What will happen when an irresistible force meets an immovable object? Here is the answer! Almost!

A FOOTBALL BOWL AWAITING A UNIVERSITY

The celestial shot that blasted the crater might have landed in some other place. On Manhattan Island the pit would be a considerable amphitheater. The main mass of skyscrapers on the lower end of the famous island could be dropped into the hole and only the Woolworth Tower would project prominently above the rim. What a pity some university doesn't locate beside it. Think of a bowl 25 times the size of Yale's!

Fully to appreciate the dimensions of this splash in stone made by a gigantic iron meteorite, one must walk around the rim. It is a three-mile tramp. The pit is 4,200 feet across, roughly four-fifths of a mile. All about are evidences of a terrific impact. The slopes of the rim are littered with crushed limestone and sand-

stone rock of all sizes. Where could white sandstone come from in a limestone desert? It is necessary to look within the crater again and see bared deep below, 300 feet or more, a belt of white sandstone. On the east and west slopes especially, the blocks tossed out have astonishing proportions. The largest is estimated to weigh more than 7,000 tons. One slab 10 feet thick leans drunkenly, like an old menhir, fully a half mile from the crater.

It is estimated that the meteorite displaced more than 200,000,000 tons of rock. In an instant it removed material equal to a quarter of the amount of material excavated in digging the Panama Canal.

The rock strata have been lifted up, wrenched, and wedged into seemingly impossible angles. On the south side the rock layers have been lifted almost vertical, and there they stand, grotesquely yet significantly, pointing toward the north.

THE DIFFERENCE BETWEEN METEORS AND METEORITES

For thirty years, at least, Meteor Crater has been less a bowl than a football for scientists, professional and amateur, in the fields of astronomy, geology, physics, engineering, and even ballistics. Most authorities agree now that the crater is indeed the mark of a gigantic mass of meteorites. Probably it can be considered the tomb of a small dead comet.

The "accident" may have happened in this manner: A close-knit mass of nickel-iron, débris of a burned-out comet, came bowling along the elliptical course around the sun which it once traveled in a more brilliant fashion. Its route happened to coincide with that of the earth—a rare circumstance, indeed. Some hundreds of miles from the earth the comet may have snagged itself in the gravity net of the planet. The mass of iron swung in, traveling probably between 25 and 40 miles *per second*. Our atmosphere began to put on pressure to reduce the meteorite's celestial momentum to earth's traffic laws. Terrific speed created tremendous friction. Rich oxygen in the earth's atmosphere blowtorched the iron. The dead comet shot downward glowing like a brake shoe.

Earth's deep air cushion of atmosphere was unequal to this Juggernaut of metal, with a diameter variously estimated at from 300 to 500 feet and a minimum weight of a million tons.

Supersunlight blazed down on desert and mountain for a moment; then plain and peak shook with a dull, earthquaking thud. Into the air billowed a cloud of rock dust. Explosions rent the cloud. Jets of steam shot like geysers through it. Dust billowed again and the wind swept it far abroad. Clearing air exposed a great circular pockmark in the grassless desert.

While few incidents in Nature are more dramatic than the arrival of a meteor, there are few objects of less dramatic appeal than a meteorite. A meteorite is a meteor come to earth. Meteors pencil the calm of a starlit sky with streaks of light. Their fire rises quickly to crescendo and dies. Their usual fate is to perish in the blaze of their own histrionics. Some escape the clutches of gravity and dash back into the black alleys of the universe once more. Only occasionally does the end of a meteor's arc touch earth, and when some person finds the "pot" of iron or stone it is always a hideous black thing seared by the fires of friction. It is hard to believe that the dark-brown, misshapen lumps one sees in the museums carrying the label "meteorite" are the glorious night riders of the heavens.

Visitors to the American Museum of Natural History, in New York, approach that hall of wonders for the first time with a variety of expectations. They think, perhaps, to walk in upon a collection of thick-hided prehistoric animals.

Some hope to meet at the door the stuffed representatives of the modern animal and bird kingdoms. It is with considerable surprise, therefore, that nearly everyone enters the large elliptical reception hall, the place of honor, to see not a diplodocus, not bears or birds, not flowers, not Indian families in wax, not gems or beautiful stones, but a score of white pedestals, on each of which is a rusty, weathered, meteorite mass—a meteorite collection.

To the left of the entrance is Peary's Cape York mass, reigning monarch of meteorites. Yet one must have something of the scientist's love of abstract facts to work up any enthusiasm over this prize. It is a pitted mass about as large as an old-fashioned concert grand piano. But no pair of piano movers could budge it, since this meteorite is solid nickel-iron and weighs 36½ tons. A view of it does help

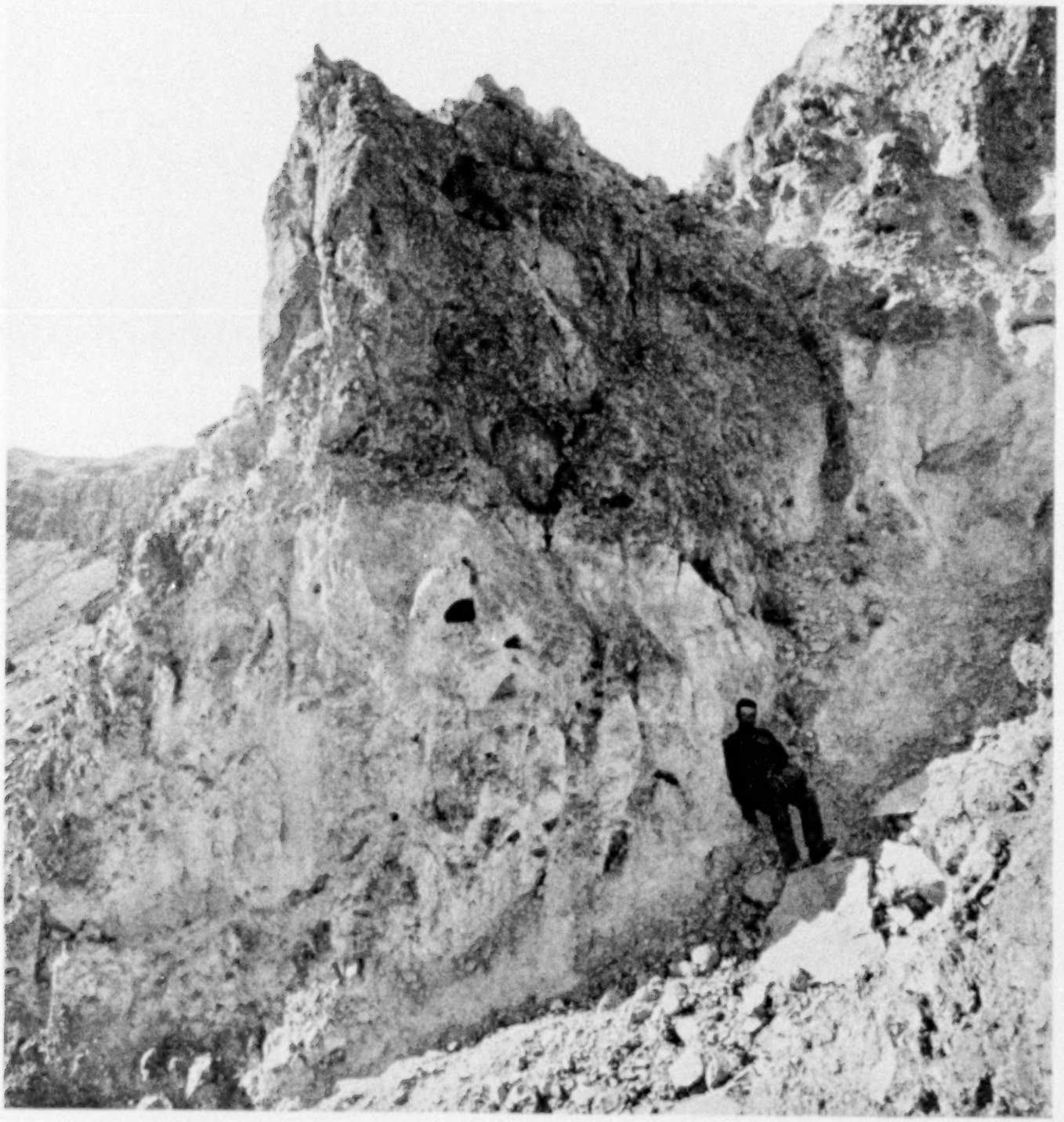
WHERE SOLID ROCK FLOWED LIKE WHEAT: THE OUTER SLOPES OF THE CRATER

Hopi Indians regard Meteor Crater with superstitious awe. Members of the tribe come periodically to obtain the powdery white rock flour from the outer slopes for use in religious ceremonials. Rock flour consists of grains of sandstone pulverized by shock (see page 729).

Photographs Courtesy U. S. Geological Survey

THE THREE-MILE PATH AROUND THE INNER RIM LEADS OVER BROKEN ROCK

Minute diamonds have been found in carbon pockets within the meteorites of Meteor Crater. Note the angle at which these rock strata have been propped up.



Photograph Courtesy U. S. Geological Survey

WHERE MOUNTAIN CLIMBING IS INVERTED: THE FACE OF THE RIM

Dark-red iron stains in the white rock identify meteoric iron within the crater. Digging usually discloses a badly rusted object called a "shale ball," the nucleus of which is nickel-iron. Twenty-nine of the 90 known elements, which are Nature's building blocks for water, land, and air, have been found in meteorites. The fragments from the Meteor Crater region contain 93 per cent iron, 4 to 8 per cent nickel, and carbon, phosphorus, cobalt, sulphur, and silicon.

one appreciate that gash in the desert near Winslow. Opposite stands one of the largest meteorites picked up in the vicinity of Meteor Crater, a roughly spherical blob of metal about the size of a large medicine ball.

MYSTERY STILL SURROUNDS THE CRATER

Meteor Crater itself holds an audience better than the museum pieces, for its story is still overlaid with mystery. The bold evidence of the meteorite's arrival is spread for any eyes. Samples of it are scattered by the ton on the surrounding plain, where Winslow residents hunt them on a holiday much as boys search for Indian arrowheads. The dimensions of the mass have been figured by experts in ballistics.

Much money has been spent to drill holes and tunnels for this meteorite. In 1922 drillers struck something hard that

Photograph Courtesy U. S. Geological Survey

THE INSIDE OF THE CUP

Wind and rain have carried down dust, sand, and rock, so that Meteor Crater is not nearly as deep as it once was. Near the very center of the bowl, there is a slight eminence which may correspond to the cones which appear in the center of so many craters on the moon. Fast photographic studies of water drops have revealed a momentary reaction following the initial impact, in the course of which the center lifts up at the same time the encircling wave starts spreading. Some scientists think that similar action occurred at Meteor Crater and on the moon, where, however, the material raised up in the center of the splash could not flatten out again.

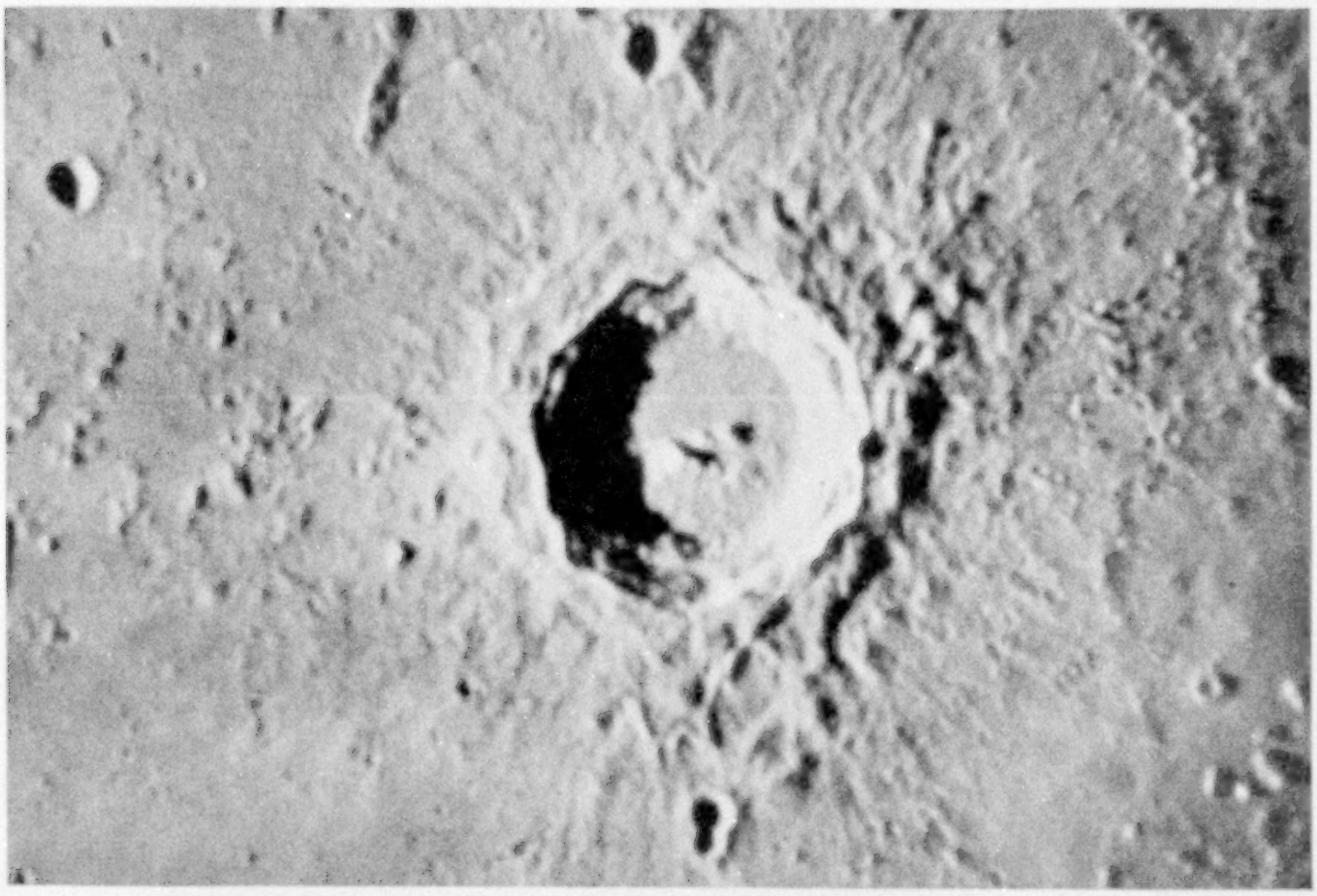
seized their drill and held it. Yet no man can say for certain that the main mass of the meteorite is in such a place, at such a depth, and is of such and such size. The unraveling of this mystery is a real challenge, for its solution would mark a red-letter year for science.

Hunting for the body of the meteorite began in 1906. The history of these operations and the results have been reported in brief as follows: A shaft was sunk directly in the center of the crater, where there had been a small lake bed at one time. Quicksand made it impossible to continue the shaft; so the crater floor was drilled at various other points. Iron-stained sand was the only product of this work.

Then geologists began to examine the crater walls more in detail. They observed that the tilted angle of the rock strata varied. On the south side it was raised nearly 90 degrees; on the north side no more than 5 degrees from the horizontal. They noticed that the tilt was progressively greater on both sides from north to south; also, that a whole 2,000-foot sector of the southern wall was lifted vertically about 100 feet. From this and other evidence the conclusion was reached that the mass of the meteorite struck from the north at an angle, crashed through the limestone and sandstone, and imbedded itself in a harder red sandstone at a point under the south wall of the crater.

The present derrick was erected on the south rim, therefore, and drillers recommenced work in 1920. Shattered and torn rock made the work difficult. At 300 feet the drill was lost. No amount of fishing could retrieve it. So a drift shaft more than 300 feet long was dug in the inner wall of the crater to get the drill.

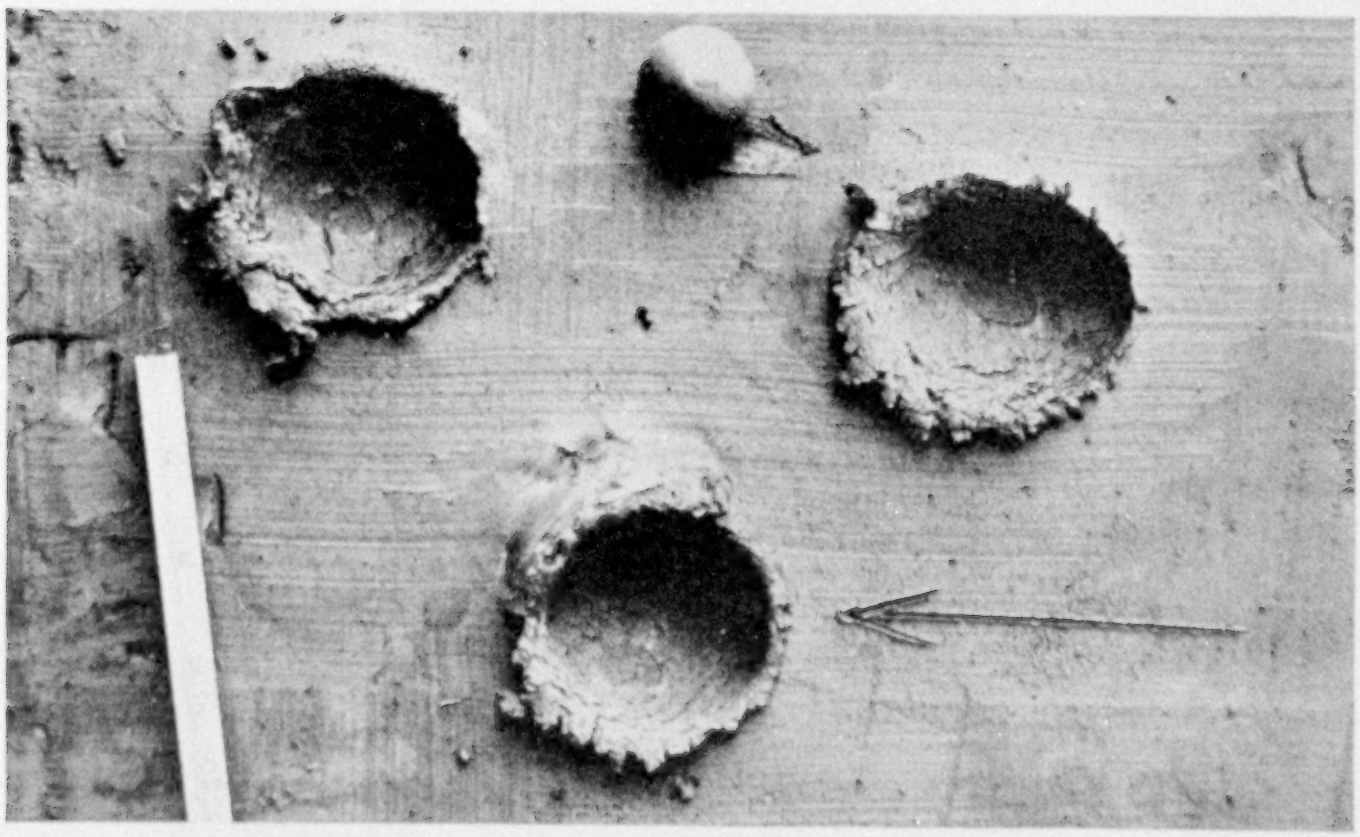
A surprising discovery was made when the laborers completely cut through the slope of rock débris and reached the actual rock wall. Fast in the wall they found



Photograph from Mount Wilson Observatory

THE SCARRED FACE OF THE MOON SEEN THROUGH A 100-INCH TELESCOPE

Strong evidence supports the theory that both Meteor Crater and the craters of the moon are tombs of meteorites. Copernicus, one of the largest of the lunar craters, is 55 miles from rim to rim. More than 30,000 craters have been counted on that hemisphere of the moon which is turned constantly toward the earth. Thousands of them are larger than Meteor Crater.



Photograph Courtesy U. S. Geological Survey

CRATERS MADE BY A MUD BALL THROWN INTO A MUD CAKE

When first the theory was advanced that the crater near Winslow, Arizona, was the mark of a meteorite, physicists looked to it for an interpretation of the craters on the moon. The objection that moon craters showed no glancing blows immediately presented itself, but Dr. Grove Karl Gilbert proved with mud balls that an object thrown obliquely will make a hole similar to that made by an object descending vertically.

Photograph by Capt. Albert W. Stevens

THE GRAVE OF THE METEOR SEEN FROM AN ELEVATION OF 5,000 FEET

From rim to rim, Meteor Crater measures four-fifths of a mile. It is 570 feet deep. Millions of tons of stone were pulverized and splashed out, creating the numerous mounds encircling the crater. The specks on the left edge are stone blocks weighing thousands of tons (see illustration, page 730). When this view was made the airplane was flying northwest of Meteor Crater, and was, for the moment, on almost the same line and angle from which the meteorite is supposed to have struck. A drilling derrick surmounts an upraised sector of the far side, beneath which the main mass of nickel-iron is believed to have buried itself to a depth of more than 1,300 feet.

two shale balls consisting of oxidized meteoric iron. It is thought that following close upon the heels of the main body of the little comet was a "tail" of smaller pieces of iron, some of which lodged against the crater wall, where the drift shaft exposed them, and some of which distributed themselves broadly on the surrounding plain.

THE DRILL IS LOST AT 1,376 FEET

Once the drill was recovered, the hunt for the iron mass began again. At 1,000 feet evidences of iron stain began to show. At 1,200 feet the drill went through powdered iron like that found around rusted meteorites discovered in the near-by desert. By the time the boring reached 1,300 feet the sludge often showed 50 per cent nickel-iron.

On August 11, 1922, at 1,376 feet the drill lodged in something hard and solid. It would not budge. Drillers tried all the tricks of oil-field fishing on the tool. Dynamite was exploded deep in the hole. All to no avail. The working had to be abandoned. Probably the goal of 18 years' effort was attained. But the condition of the iron and the amount of it there remain a mystery.

Although thousands of pioneers passed over the Santa Fe Trail within a few miles of Meteor Crater, the uniqueness of this world wonder escaped notice until Grove Karl Gilbert, the geologist, suggested the meteorite theory in 1895. Scientists were at first loath to believe that a meteorite blasted the crater. No other meteorite has been known to penetrate more than 11 feet in the ground. Most of them go no farther than a few inches, owing to their small size. In Norway one hit a frozen lake and bounced along without breaking the ice. In Sweden another fragment bounded on a housewife's washing without tearing or scorching the linen.

While Meteor Crater has no brothers on the face of the earth, probably there are thousands of similarly blasted craters within sight of everyone. That is a paradox which can only be explained with a telescope. Some bright moonlight night look at the man in the moon through a telescope and you will find that his shining face is badly pockmarked. More than 30,000 craters have been counted on the hemisphere which the moon turns constantly toward the earth. There is very strong support for the belief that all of them, like Meteor Crater, are tombs of meteorites. They may record far greater impacts than Meteor Crater. One of the largest is Copernicus, 55 miles across (see page 727).

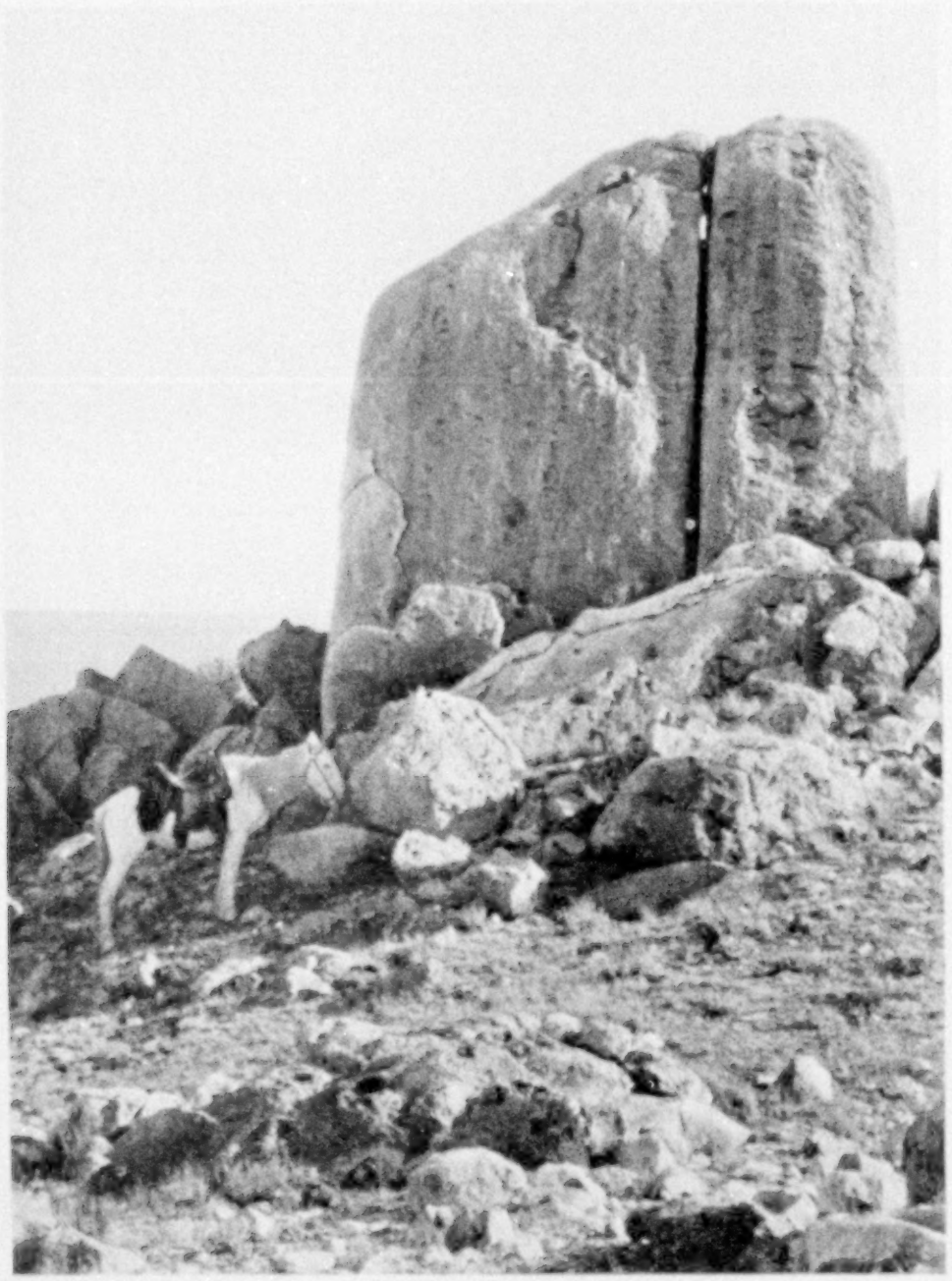
The pitted face of the moon may be a model of what the earth once looked like, and perhaps what the earth might look like to-day had it, like the moon, no atmosphere to serve as a protective cushion.

Since the moon has no atmosphere and no rainfall, it has no protection and no erosion; so it has been unable to cover up the scars of celestial battering. Our sun and planetary system, physicists believe, were born out of the wreckage of an older system. Mars, Jupiter, the earth and all the rest are supposed to be picking up fragments of that ancient system in the form of meteorites. Of course, the chief accretions came when the planets were young; so it is assumed that the moon's meteorite scars are very old indeed. On our planet, sediments, rock upheavals, sinkings, and weathering have smoothed out any pits.

Evidence of tremendous shock is everywhere to be found in and around Meteor Crater. Nothing is more eloquent of collision than the tons upon tons of fine white sand in and out of the crater. On the slopes it seems to have flowed like wheat in a grain elevator. This rock flour, almost as soft and fine to the fingers as talc, will pass a two-hundred-mesh screen. A microscope shows the grains to be shattered bits of larger pieces. In the powder have been found quartz grains of the sandstone still whole, but cracked through and through by shock. If the pressure of a penknife blade is brought down upon the grain it breaks into pieces identical with the bits of rock flour.

THE HOPI LEGEND AND A WILD INDIAN

The use of the pure white rock flour in Hopi religious ceremonies links the crater with a legend current in that tribe. Three of their gods, the Hopi believe, came down from the clouds onto the desert. One made his abode in Meteor Crater and the other two some distance north. Acting on the hint of the legend, search has been made in the region north of the railroad. The other two "gods" may have been smaller attendant meteorites whose tombs have not been located as yet.



Photograph Courtesy U. S. Geological Survey

A PEBBLE FOR CYCLOPS

On the eastern extremity of the rim of Meteor Crater stands the largest of the limestone bowlders tossed out. Huge rocks are found half a mile from the crater (see, also, text, page 723).

That Meteor Crater should have a place in the legends of the Hopi indicates a fairly recent origin. Geological study confirms this point of view. The pit cannot possibly be younger than 700 years, because cedars cut on the rim show that number of annual rings; but the weathering on the rock thrown from the crater shows that it is probably not older than 5,000 years.

The religious significance of the meteorite to the Hopi finds interesting parallels elsewhere. The sacred stone in the Kaaba, at Mecca, which all Moslems hope to kiss, is a meteorite. It was considered sacred long before Mohammed brought new importance to the shrine. Meteorites have also been found in the temples of the Aztecs in Mexico. One was discovered in a cliff-dwelling in Colorado. Several stones kept in Greek and Roman temples were probably meteorites.

One of the oldest meteorites which has been preserved through the centuries is the "Bewitched Burgrave" of Ensisheim. One month after Columbus discovered America a 300-pound meteorite fell near this Alsatian town. The superstition got about that the ball of iron was really a late tyrannical official of the neighborhood who had been turned into iron as punishment for his cruelty. The visitor to Ensisheim to-day will be shown the "Bewitched Burgrave" hung from the rafters of the old town hall.

An ugly meteorite fragment from Meteor Crater is as vital to the scientist's theory of the unity of the universe as the black iron in the Kaaba is to the religious concepts of Islam. The scientist's spectroscope tells him that the earth is made of the same stuff as the stars; his telescope reports that the earth's motions are in tune with the stars, sun and planets; but a meteorite is something that a scientist can take in his hand and examine. He can put in his test tube this piece of matter fallen on the Arizona desert. He can compare its minerals with minerals of the earth. Then he can say that the stuff of the stars is the stuff of the earth; and thus a meteorite helps to prove that every particle fits into a single plan which we are learning to understand.

HOLIDAYS WITH HUMMING BIRDS

By Margaret L. Bodine

With Illustrations from Photographs by the Author

THE porch of our summer home in Maine is only 11 by 13 feet, quite in proportion to the Humming Birds which spend so many satisfying hours there. It is a second-story affair, bounded on two sides by the walls of the cottage, which is built on a bank. A clematis vine grows there in profusion, and on the wide railings are flower-boxes, which first made this nook known to our winged visitors. However, the flowers are not the secret of the porch's attraction for them, but miniature bottles, about two inches long, covered with some bright-hued material and filled with sugared water.

These bottles are fastened among the blossoms and are speedily discovered by the Humming Birds. Once found, there are few daylight hours from the middle of June till September when at least one is not there. Sometimes as many as eight are feasting at a time.

On the day after our arrival at our summer home last year we put the little bottles out, and in less than ten minutes the first Hummer came, drank, and perched.

HUMMING BIRDS HAVE "TELEVISION"

The Humming Bird's powers of vision are marvelous. One of the little mites, which we discovered for the first time with field glasses, sitting on a branch of a tree several hundred feet from the porch, watched us from there when we filled the bottles and was at the tip of the medicine dropper which was used for this purpose, before we were through. This happened very often, and, as much of her time was spent on the same twig of this bough, we felt that her nest was probably near by. But the tree was a very tall one and it was not possible for us to prove it.

There is more individuality in birds of all species than is generally realized. The marking and shape often vary, but more especially do their actions differentiate the members of one family, and for this reason we were able to recognize certain Humming Birds whenever they came to see us. "Crazy Jane" is an example. A friend named her because of her habit of invariably drinking from the bottom of a bottle, where the overflow sugar and water ran down; never from the top, as would the average bird (see page 736).

One was quite an acrobat, clinging to the bottle with its feet and bracing itself with its tail while it drank.

ANY BRIGHT OBJECT AROUSES CURIOSITY

Doubtless what seems to be curiosity in Humming Birds is in many cases a search for food, which consists largely of insects caught in the air and of the nectar sucked from flowers. The tongues of these birds are long and tubular, and they extract the honey easily from such blossoms as the honeysuckle and the trumpet vine. They dine on many other favorites, such as the bee balm, larkspur, phlox, gladiolus, rose, and clematis.

The Hummers investigate all bright objects on the porch: a red film box; one's purple sweater, in which the long bill is poked vigorously; they poise in front of the camera's lens or close to one's face, apparently studying it; or peer into each seed-cup of the birds' merry-go-round.

The merry-go-round is a successful device invented to circumvent the red squirrel, which stole the seed from an ordinary hanging tray that was provided for other varieties of feathered guests.

One day there was a male Purple Finch in our black birch tree close by the porch, brilliant raspberry-colored in the sun, which was shining brightly on him. A young Hummer, evidently mistaking the Finch for a sweet flower, darted at him and gave him repeated jabs. The Finch, appearing much bored, moved from spot to spot and finally flew away.

Our Humming Birds have certain favorite perching places: on the handle of a fern basket; the highest point of a wishbone-shaped root, where the larger birds land when coming to us, and in the tiny swings which are made just wide enough for them to alight without brushing their outstretched wings.

One afternoon, when we returned after an absence of several hours, we found

A RENDEZVOUS OF THE TINY FEATHERED FOLK

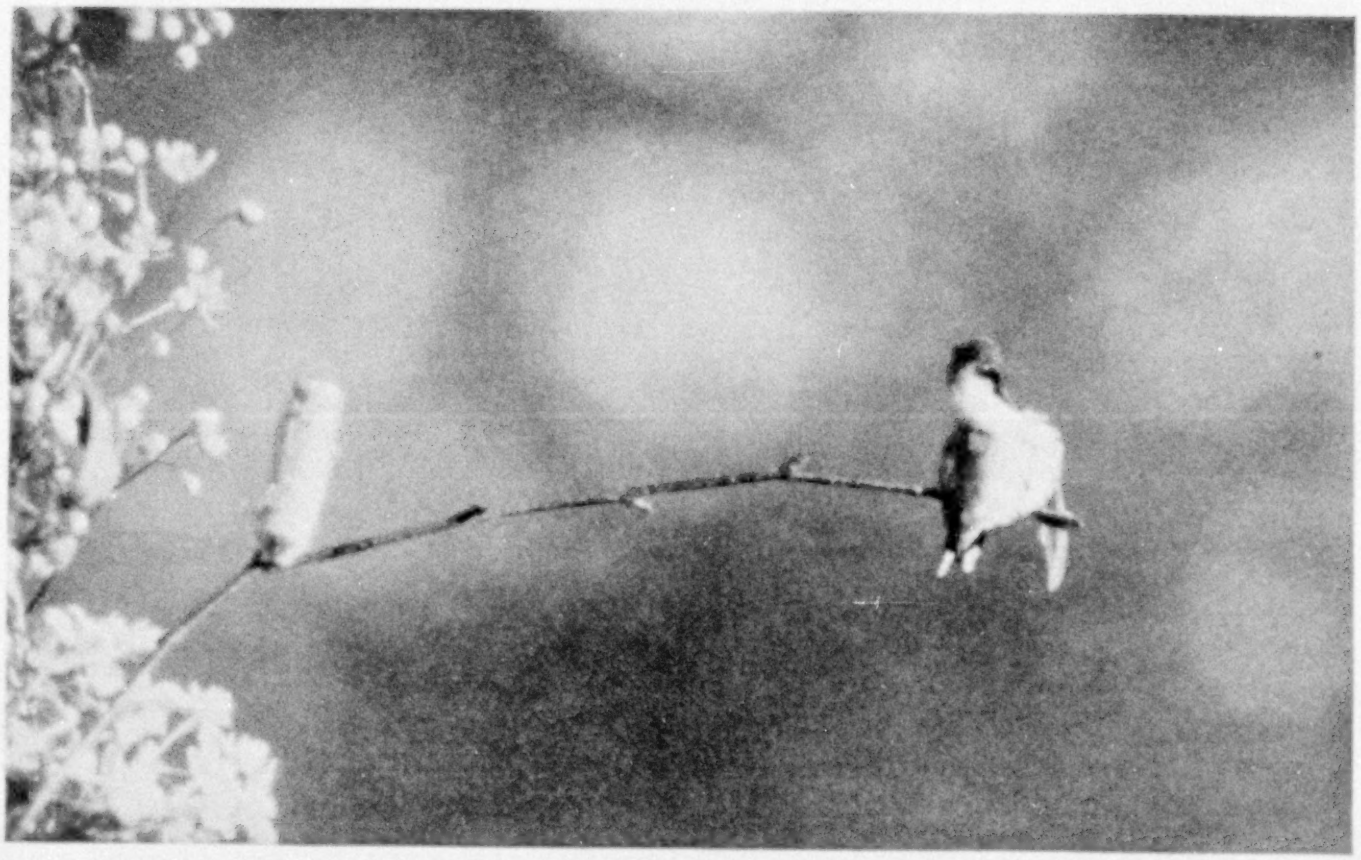
As many as eight Hummers at one time have visited this porch of a summer cottage in Maine. Other birds, chipmunks, and flying squirrels have also been attracted to its clematis-covered precincts to be "shot" by a camera (see text, page 738).

A LILLIPUTIAN BATTLE ROYAL

Nothing on wings can invade the domain of a Humming Bird with impunity. Larger birds usually forsake the field when he attacks, but bumblebees are not so discreet or else are more intrepid, for they frequently dispute the issue (see text, page 736).

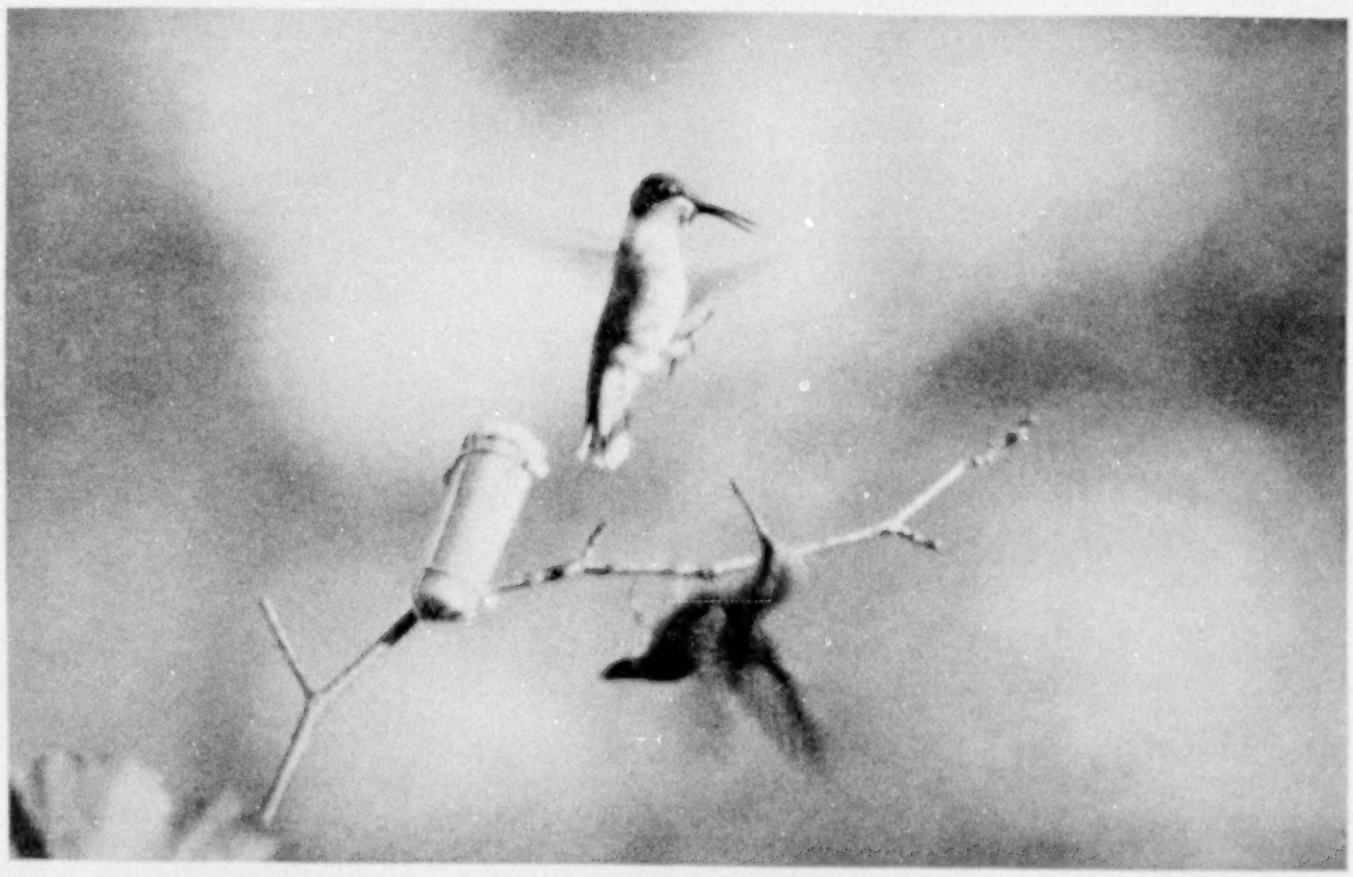
BIRDS OF MANY KINDS ENJOY THE HOSPITALITY OF THE AUTHOR'S HOME

If provided with food and drink, or shelter and sanctuary, they will soon come to be on intimate terms with their benefactors. Note the Humming Bird drinking from a bottle attached to a twig on the right (see text, page 731).



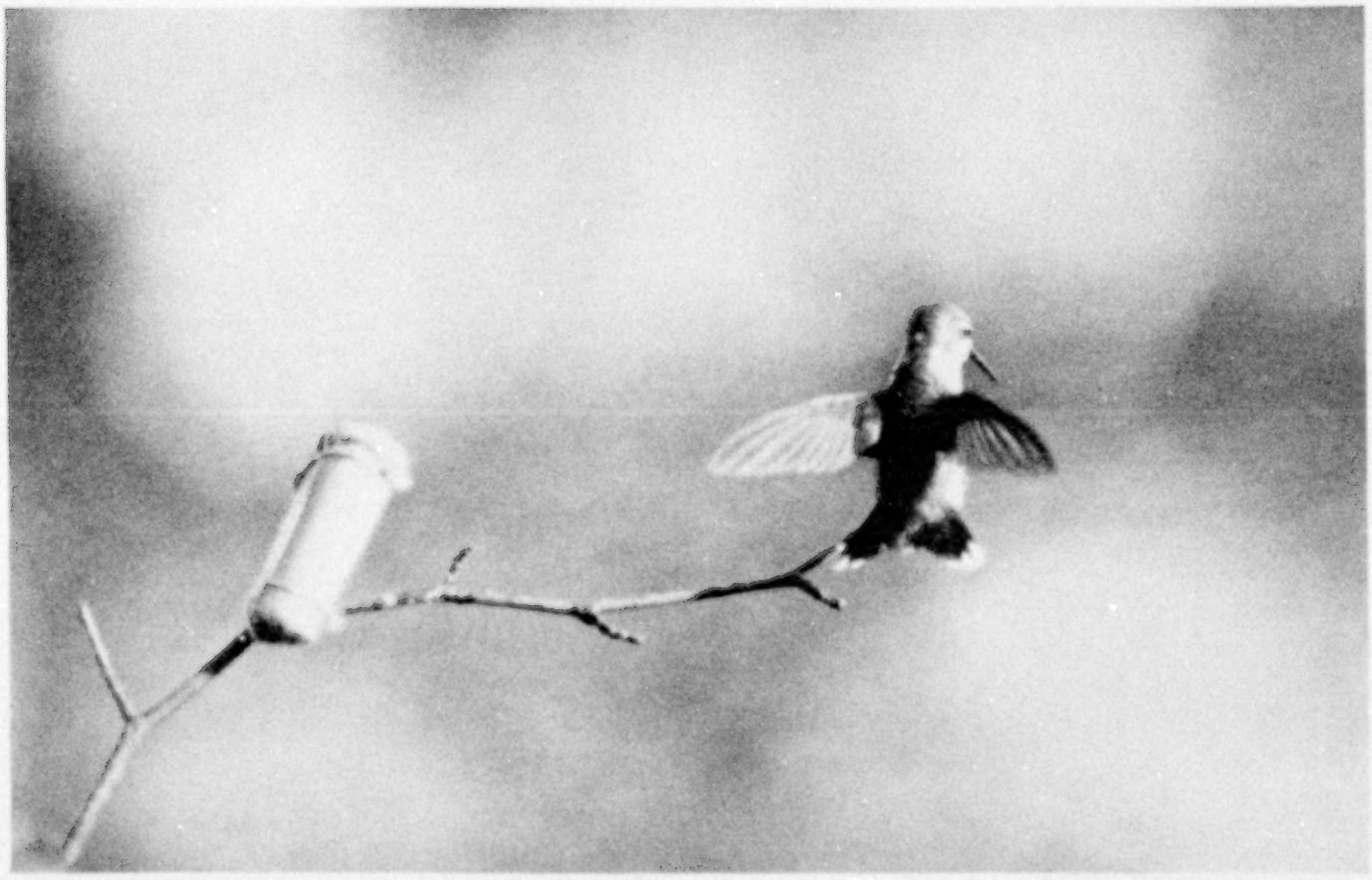
A YOUNG DANDY PREENS HIS FEATHERS

Neatness is a characteristic of these birds, and after one of their frequent combats the victor almost invariably flies back to the precise perch he occupied before the struggle, and there rearranges his disordered plumage with great dignity (see text, page 738).



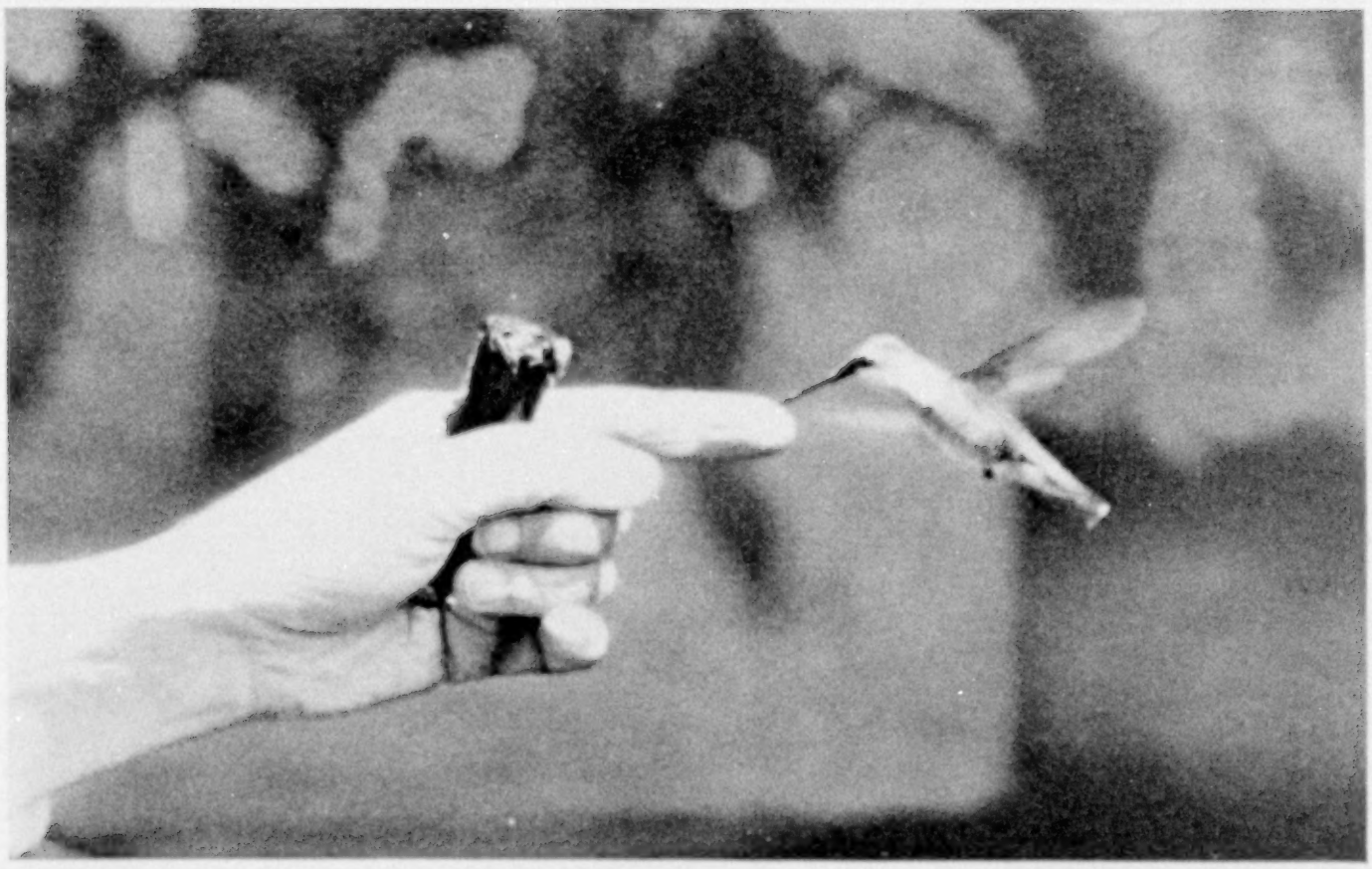
"GLITTERING FRAGMENTS OF THE RAINBOW"

The iridescent feathers of the Ruby-throat flash in the sunlight with many of the colors of the rainbow. The multifold hues of the Hummer's plumage are due not to the presence of coloring matter in the feathers, but to the manner in which rays of light are refracted by the peculiar feather structure. In this species the underparts of both male and female are soft gray, the head and back an iridescent green. Only the male has the brilliant metallic red throat.



THIS TINY FLYER IS EQUIPPED WITH REVERSE GEAR

Although the Humming Bird is easily capable of 60 miles an hour, speed is not the only remarkable feature of its flight. It is the only land bird that can really fly backward and one of the few that can rise straight up into the air like a helicopter.



LICKING SWEETENED WATER FROM A FRIEND'S FINGER

Until very recently it was not known how to keep these little sprites in captivity. Invariably, in less than two months, they starved to death, because of a lack of their regular insect food and despite an abundance of sugared water and flower nectar. A short time ago a substitute diet was discovered by two amateur ornithologists, one in New England and one in Texas, and by their methods birds have been kept captive successfully for as long as two years.

"CRAZY JANE" ENJOYS AN OVERFLOWING BOWL

This particular Humming Bird won her sobriquet because she insisted on drinking the overflow of syrup from the bottom of the bottle, where it ran down on the outside, instead of from the top, as did all her fellows. The other bird in the picture is a Purple Finch, and, although several times the size of the Hummers, will make way for them if attacked.

four Humming Birds waiting for us—a real, if not disinterested, welcome. A sight that brings a smile is that of a tiny Humming Bird perched with much dignity beside a stately Waxwing, a portly Robin, or in the midst of a flock of Purple Finches.

AN INTREPID TRAVELER

Wilson, the ornithologist, writing in 1810 of the Humming Bird and its migration, which is often from Central America to Canada, says, in the quaint phraseology of that day:

"As it passes on to the northward, the wonder is excited how so feebly constructed and delicate a little creature can make its way over such extensive regions of lakes and forests, among so many enemies, all its superiors in strength and magnitude. But its very minuteness, the rapidity of its flight, which almost eludes the eye, and that admirable instinct, reason, or whatever else it may be called, and daring courage which Heaven has implanted in its bosom, are its guides and protectors."

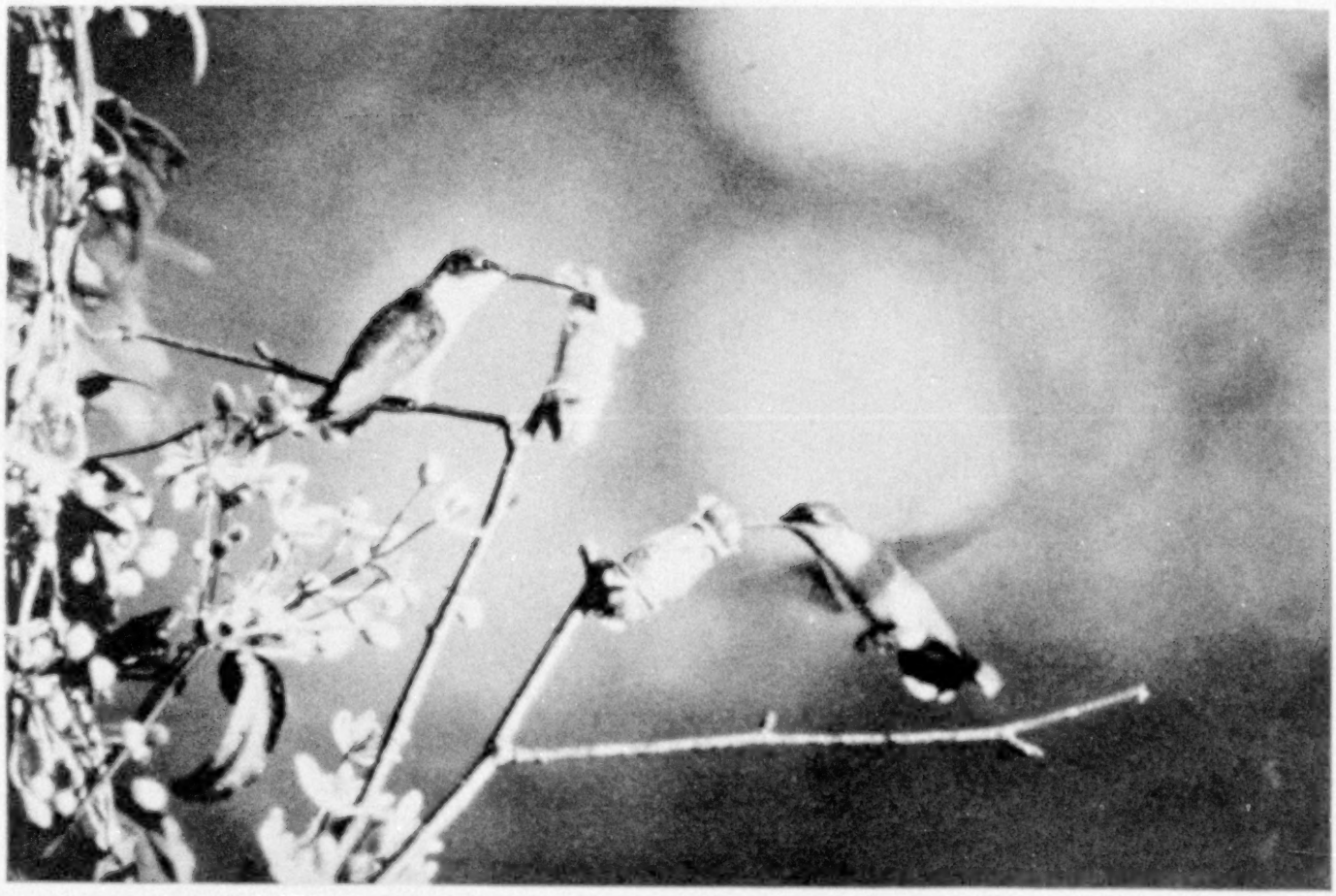
Hummers are among the most fearless of all birds, despite their size, and are quite able to hold their own in the avian world, where they are treated with wholesome respect. They will attack Hawks,

A BABY HUMMING BIRD, WITH OUTSPREAD WINGS, BEGGING TO BE FED

Like most young birds, baby Hummers have an appetite quite out of proportion to their diminutive size. The parents feed them by regurgitation, first swallowing and partially digesting the food themselves. To the uninitiated, the old birds appear to be attacking their offspring when they are in reality supplying them with predigested nourishment (see text, page 739).

DINING WHILE RECLINING—A RARE POSE

While our well-known Ruby-throat varies from three to four inches over all, in the West Indies there is a species only 2¼ inches in length; on the other hand, among the high Andes one variety of Humming Bird is as large as our unwelcome Starling. A long bill is a feature common to Hummers, and in one species the bill is longer than all the rest of the bird.



WHEN ADULT MALES ARE ABSENT, THERE IS PEACE ON THE PORCH

A syrup of sugar and water is placed in tiny bottles, wrapped in bright-hued material. The color excites the Hummers' curiosity, and it is not long before their long, tubular tongues are sucking up the fluid.

Eagles, and Crows, and I have a firm conviction that if conflicts were to occur between a Humming Bird and the Great Blue Heron, which sometimes comes to our near-by harbor, the vanquished one would never be the Hummer.

SOME INDIVIDUALS ARE EXTREMELY BELLICOSE

Observation of these small birds during the past five summers does not lead us to the conclusion that they exemplify the Christian virtue of meekness to any marked degree. For temper, pure and simple, they surely have no equal. One of our Hummer visitors apparently was frequently thrown into a violent rage by the approach of another. With tail wide spread, the white-edged tail feathers giving the effect of a petticoat showing beneath a skirt, and fairly shrieking, it would dart at the newcomer, striking viciously with its rapierlike bill.

Some days there are hours when one couple will be fighting in the air, sailing close together, then suddenly separating, dashing at each other and striking with terrific force. We hear the sound of bill striking bill, or the thud of body against body, and are always fearful of finding a dead bird below.

Such battles may account for the small dark marks which we see on the necks and breasts of some of the birds. After each duel the victor invariably returns to the exact spot which it had left, breast heaving, but with triumph written on every feather, an illustration for a "Winged Victory" (see page 734).

There have been several red-letter days in our Humming Bird summers. One of these was early in August, when there seemed to be a veritable swarm of birds on the porch. There was a constant buzzing, creaking, and squeaking, as our "boarders" darted across the porch to drive others from their perches. We watched spellbound. It was difficult to count them and we could not be sure that there were more than eight at any one time, though the number seemed much greater.

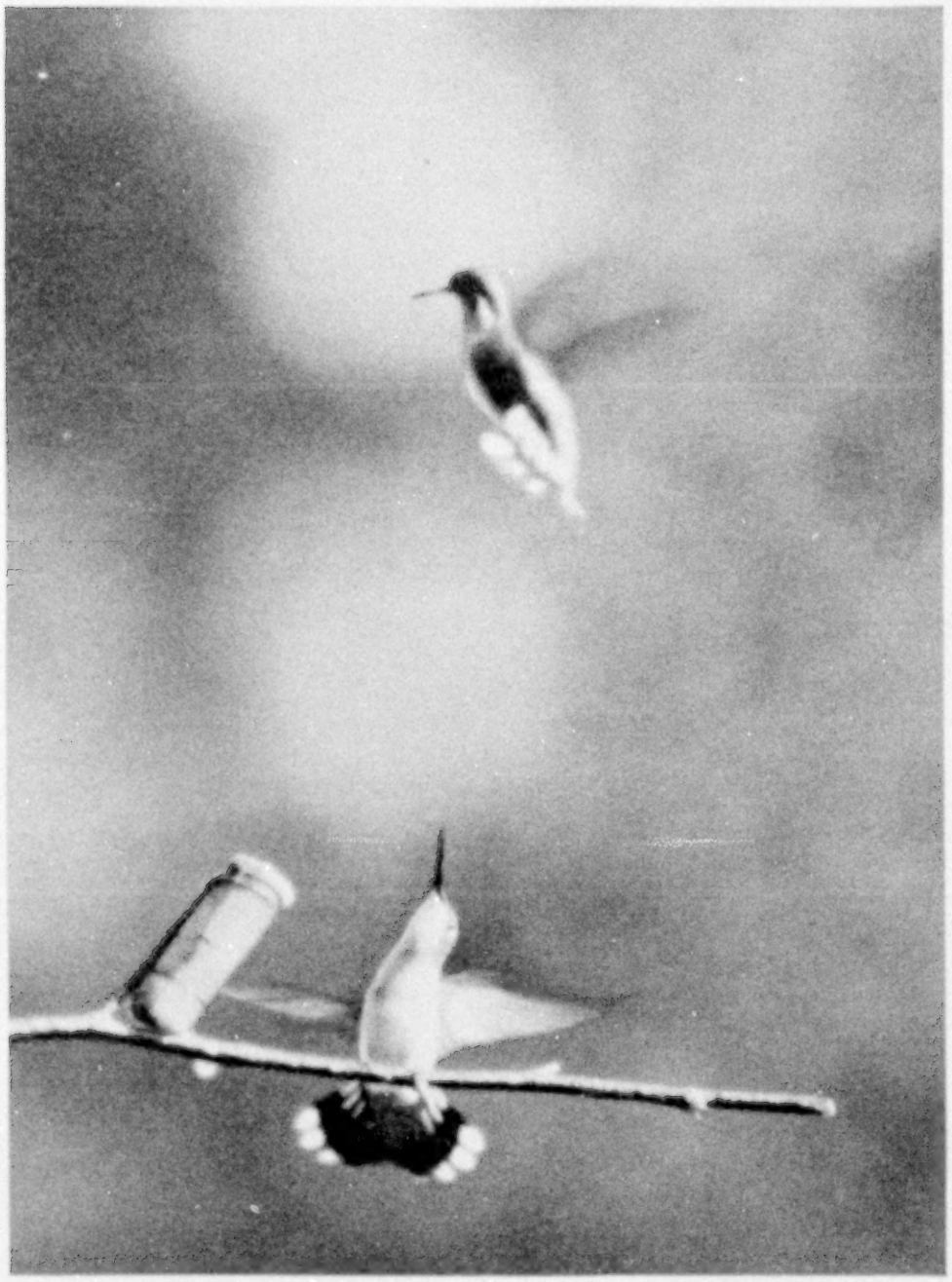
THE HUMMING BIRD FAMILY LIFE

Another day worthy of remembrance was that on which the first baby Humming Bird was brought to the porch. It was

the most diminutive ball of feathers we had ever seen and was discovered clinging tight to the clematis vine. Soon we found its twin being fed by the male Ruby-throat in the birch tree, though it is often stated that the father forgets all family cares after the nest is completed.

The nest itself is very beautiful. It is an inch or less in diameter and the same in depth, and is lined with milkweed and plant down. Usually the tiny structure is saddled to the limb of a tree and fastened securely with cobwebs.

Nests have been found on cedar boughs, beech, elm, spruce, and fruit trees; on vines, blackberry briers, the stalk of a weed; in bushes or even attached to a hammock. Indeed one may be found almost anywhere, though the parents conceal them so effectively that they are among the most difficult of all bird homes to locate. There are invariably two eggs, pure white, and the time of incubation is slightly less than two weeks, the young leaving the nest in about the same length of time.



FIGHTING IS THE HUMMER'S FAVORITE SPORT

The usual technique of Humming Bird warfare is to grasp the antagonist firmly by the bill and then fall to the ground, beating the wings viciously. There the combatants roll and beat about until one gains the advantage. The vanquished frequently pretends to be almost dead until his adversary leaves him, when he is up like a flash and off in pursuit, to start the fight again. Despite their battles, the Hummers' strength is so slight that they seldom do each other serious injury.

The little ones grew unbelievably fast and came often to the porch, though for some time they were unable to drink from the bottles. The mother fed them, and the first time we saw her do it we were quite ready to notify the Society for the Prevention of Cruelty to Children. The baby crouched flat on the perch, squeaking as if in distress, and the bird hovering over it seemed to be stabbing it to death.

We thought an alien infant was being persecuted by one of our birds until we discovered that the little one was being fed by regurgitation, the predigested food being pumped into its stomach by its mother. Often the baby would cling upside down to the perch with bill wide open, begging to be fed (see page 737).

One baby bird with a yellowish tinge on throat and breast spent much time on a porch perch making its toilet, going carefully over each feather, preening and licking it with bill and tongue. Often one

GETTING READY TO SERVE A QUICK LUNCH IN APPROVED HUMMING BIRD STYLE

When feeding her young the Ruby-throat parent usually perches on the edge of the nest or on a twig beside the baby (see page 737), but sometimes she serves lunch while on the wing, balancing herself in the air in front of her progeny. Only a bird with the tremendously rapid wing beats of the Hummer could control its aërial actions well enough to accomplish this feat. The tail with its white "petticoat" feathers showing serves as a rudder and balancer.

sees the very long tongue, which is stuck in and out with great swiftness.

Several times a Hummer has perched quite calmly on a friend's extended finger, once running its tongue lightly along where sweetened water had been placed—the most gentle touch imaginable (p. 735).

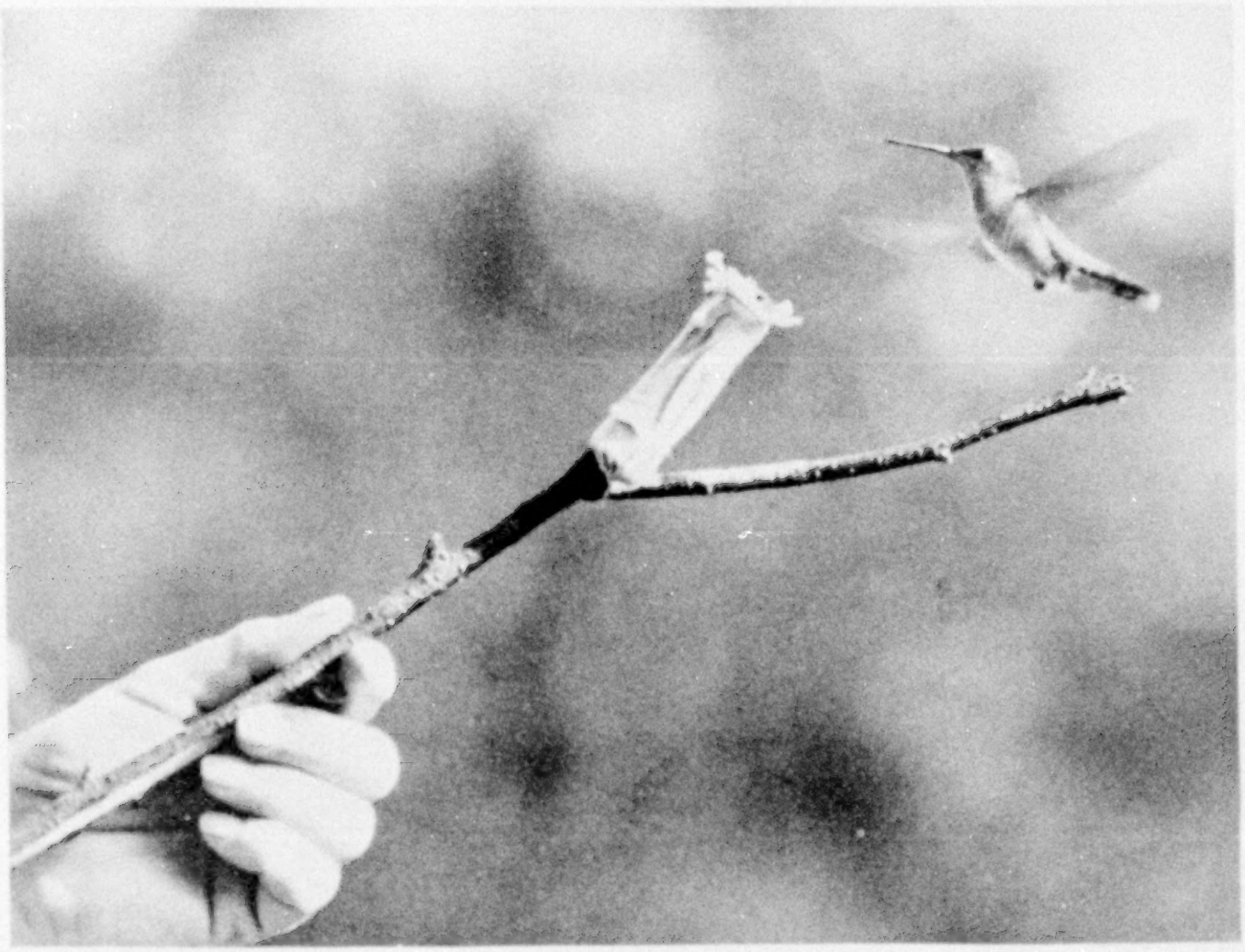
One summer, for some inexplicable reason, no adult male Humming Bird was seen on the porch, although there were the usual females and immature males. We missed seeing the gorgeous red throats, but that was our most peaceful summer, with many photographic opportunities. The following and each succeeding summer we have had several males, who have appropriated the porch as a private club and have driven away with much fierceness all females and young birds. They have guarded the premises either from a perch on the porch or from a near-by tree and allowed no other Hummers to touch the sweetened water, whether or not they themselves wanted to drink.

The male is very beautiful, as he weaves his way back and forth before his lady-love in the mating season. She sits quietly on a twig as he sails slowly up and down, up and down before her.

Another pretty sight was that of a Hummer flying up the trickling stream of water overflowing from the bird bath on the railing, then settling down on a large leaf, spreading its feathers out and evidently enjoying the wet.

We have a vivid recollection of the first time we saw two Humming Birds sitting side by side on one of the porch perches. Audubon has called them "glittering fragments of the rainbow," and truly, as the sun shone dazzlingly on them, it was a charming picture.

A mother bird will allow one of her children to perch with her, but woe betide the intruder who attempts to share her resting place. It is an amusing and ludicrous sight to watch the parent bird take her stand on a perch and protect it against all interlopers. She herself will drink and



A HUMMER'S WINGS MOVE FASTER THAN AN AIRPLANE'S PROPELLER

So rapid is the oscillation that the wings of these feathered mites appear merely as a blur to the eye. By striking a note on a violin which exactly harmonized with that of the tone of a Hummer's wings, it has been found that the latter vibrate as much as 200 times a second. This is five or six times faster than the propeller of the famous *Spirit of St. Louis* revolves.

permit her children to do so, but flies into a fury at the approach of others, spreading her tail and wings wide, darting at them violently, and looking so formidable that only the bravest would dare try to stay near her for long.

PROBLEMS IN PHOTOGRAPHING HUMMERS

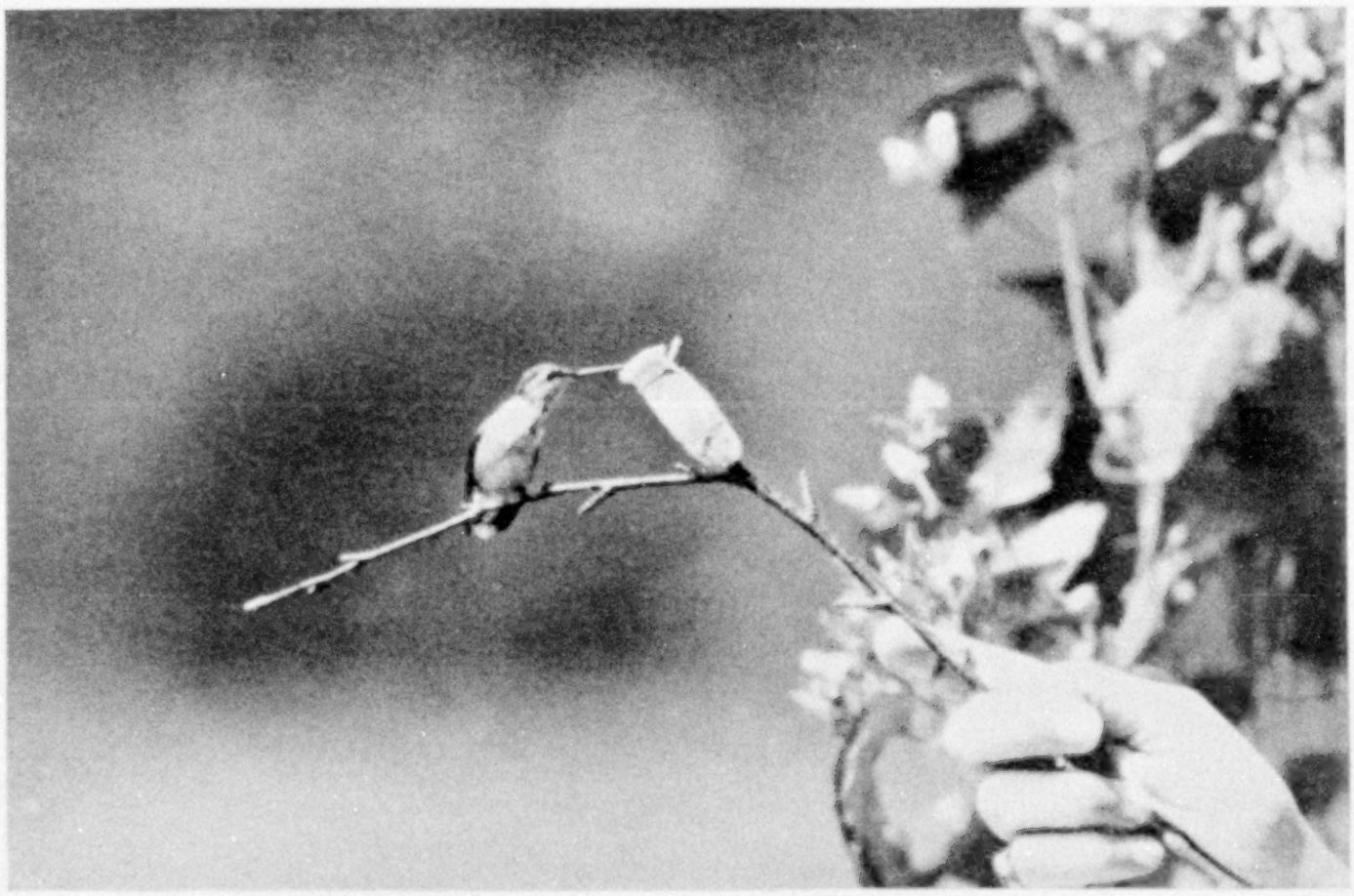
Photographing Humming Birds provides sufficient difficulties to make it an interesting specialty, arousing one's sporting instinct. One does not like to feel an "inferiority complex" caused by a creature little more than three inches long.

A goodly proportion of the Humming Bird's life is spent on the wing, the very powerful muscles used in flying being attached to a strong and prominent breastbone. To try to match the speed of its wings with a camera's shutter furnishes no small amount of excitement and at the same time something of a problem. For this kind of work it has been found preferable to use a camera which enables the photographer to see his image on the ground-glass, and focus accurately up to the second of exposure.

When pictures of the Humming Birds are to be made, a small perch is fastened in the vines wherever the light is best—fortunately for the photographer the Hummers are great sun-lovers—and a bottle is placed close by. All the other bottles are temporarily removed in order to force the birds to the desired spot. Diaphragm and shutter are made ready and the photographer waits, and seldom has to wait long, for a pleasing pose. The perch is indispensable, for the birds love to rest between their long drafts.

Even when the bottle is almost entirely concealed in the vines, with the object of making a more natural-looking picture, the Hummers find it very quickly.

Frequently, owing to their excessively fast movements, a developed film reveals



BANDING A HUMMER IS A DELICATE OPERATION

This bird is one of the very few of its species that have been successfully banded (see its right leg). Indeed, so great are the mechanical difficulties in getting a suitable band and so delicate are the tiny legs that the bird-banding division of the U. S. Biological Survey rather discourages the practice of banding Hummers. The only banded birds of which the Survey has a record of their return to the bander are the three which have come back to the author's friend in Maine (see text below).

a surprise, as in one picture which resembled an irate parent holding the traditional birch rod, the baby cowering beneath the perch in terror. This was supposed to be a feeding picture.

BANDED HUMMING BIRDS RETURN TO SUMMER HOME

An enthusiastic bird lover is a summer neighbor of ours. She lives at a near-by inn, where she has a unique third-story bird window, a feeding and banding station combined. There she has performed the extremely delicate operation of putting microscopic bands on a number of Humming Birds (see illustration above), and has succeeded in getting several back and checking them up as "returns," indicating that Hummers are constant to a locality.*

The game of attracting the Humming Birds has proved a most rewarding one, and the attempt to catch these diminutive creatures with lens and shutter on a photographic plate is an alluring pastime.

Pope says:

> "Yet by some object every brain is stirr'd;
> The dull may waken to a Humming Bird."

The writer, indifferent to the implication, is thankful for many joyful hours she has had because of this awakening.

* See, also, "Bird Banding, the Telltale of Migratory Flight," by E. W. Nelson, in the NATIONAL GEOGRAPHIC MAGAZINE for January, 1928.

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That modern axiom of proper diet, "Eat plenty of vegetables", points straight at Campbell's Vegetable Soup for your table.

* * *

Remember that in such well-made vegetable soup there is comparatively slight loss of the valuable mineral salts, so apt to be boiled away from vegetables prepared in other ways.

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Your grocer has, or will get for you, any of the 21 Campbell's Soups listed on every label. 12 cents a can.

WITH THE MEAL OR AS A MEAL SOUP BELONGS IN THE DAILY DIET

A home town enterprise backed by national experience

An Advertisement of the American Telephone and Telegraph Company

THE Bell System is a home town enterprise in operation so that each community may have service that suits its needs. It is a national enterprise in research, engineering and manufacture so that every telephone user may have the best that concentration and quantity production can achieve.

There are twenty-four operating companies devoting their energies to telephone problems throughout the United States—for example, the Northwestern Bell Telephone Company operating throughout Iowa, Minnesota, Nebraska, North Dakota and South Dakota. It has 11,000 men and women—friends and neighbors of the other people in their towns—working to maintain in its territory the best standards in telephony now known.

In New York, in the American Telephone and Telegraph Company and the Bell Laboratories, are 5000 persons, including scientists, engineers and consultants in management, engaged in inventing better apparatus and discovering better ways to do things.

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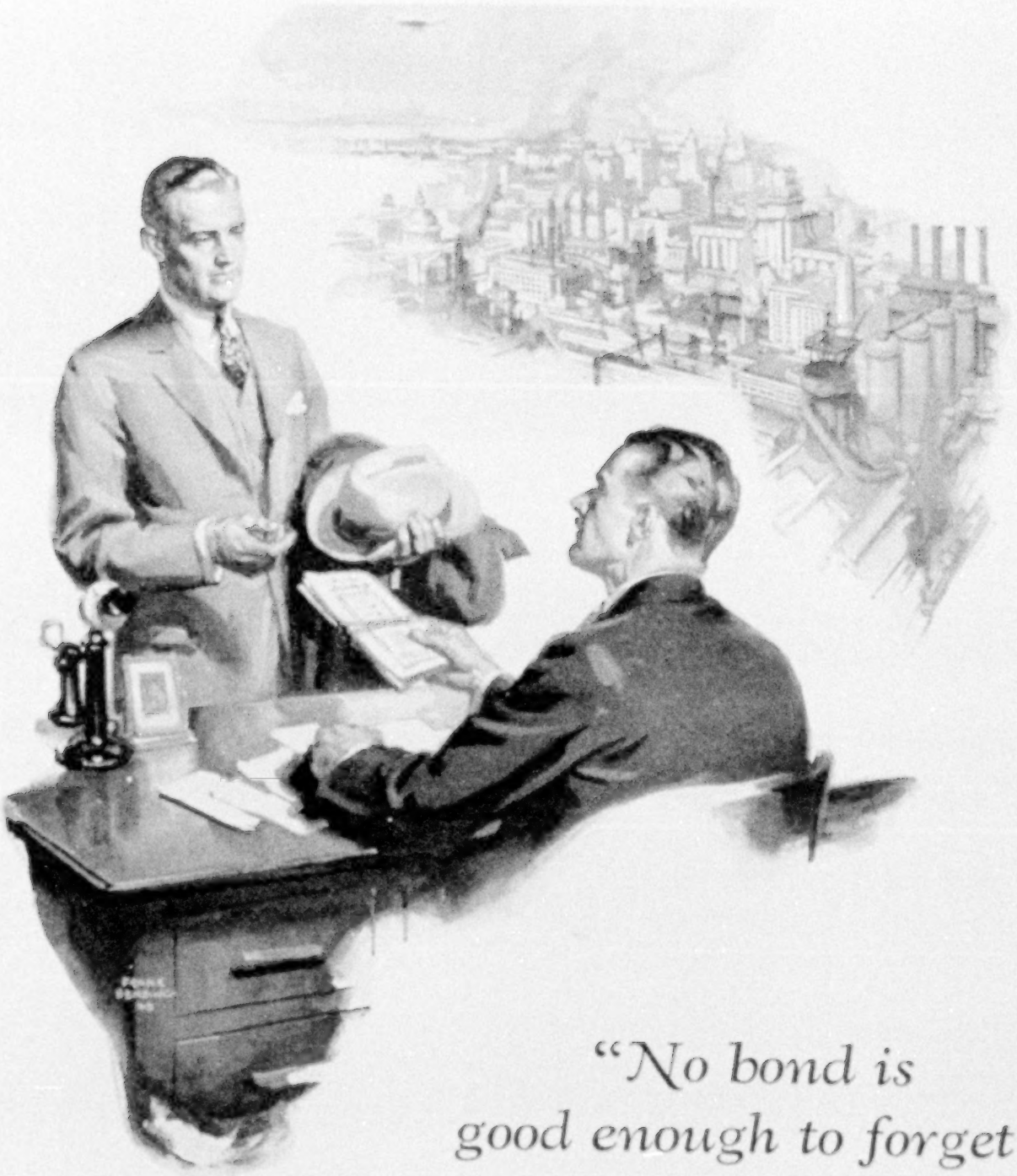

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Our current list presents a wide choice of investigated issues. It will be sent upon request.

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Gillette must do a different job for you each day

—*with a blade which does* all *of them superbly*

THE weather may be fair or foul, warm or freezing; the water may be hot or cold, hard or soft; your digestion, too, affects the comfort of your shave; so do your nerves—how well you slept, and how long you lather.

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To be sure of a smooth, comfortable shave under *any* conditions, slip a fresh Gillette Blade in your razor.

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No matter where you go, the very name Chrysler is spoken with a special emphasis, a special significance, a special warmth which indicates unmistakably the conviction that there is nothing offered which compares with Chrysler in first cost, last cost, and in supreme satisfaction.

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DETROIT, MICHIGAN

The *best* gasolines become *better* when ETHYL is added

RACING car drivers *can't* take a chance with their engines.

Before a race they test their cars with the best gasoline obtainable. Then they add "Ethyl" fluid—the anti-knock compound—to develop the last ounce of power for speed and safety.

Similarly, leading oil companies are adding "Ethyl" fluid to the gasoline produced for the general motoring public, so that your car too may increase its performance under all driving conditions.

This fuel is called Ethyl Gasoline and is sold at pumps which display the emblem shown below.

Read the facts about Ethyl Gasoline given below. Remember that even the best gasolines become better when "Ethyl" fluid is added.

ETHYL GASOLINE CORPORATION
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What Ethyl Gasoline is

ETHYL GASOLINE was developed by General Motors research to provide a more efficient fuel for internal combustion engines.

It is formed by adding Ethyl brand of anti-knock compound ("Ethyl" fluid) to selected motor gasoline in an amount sufficient to utilize the higher compression created by carbon deposits or advanced engine design.

"Ethyl" fluid is a concentrated liquid containing tetraethyl lead which has the property of controlling the combustion rate of gasoline. It is a patented product.

Ethyl Gasoline is colored red for identification. The color has nothing whatever to do with its performance. It takes more than dye to make "anti-knock" gasoline.

Ethyl Gasoline is sold only at pumps which display the "Ethyl" trademark.

Ethyl Gasoline is the yardstick by which other gasolines are measured.

ETHYL GASOLINE

ETHYL
BRAND OF ANTI-KNOCK COMPOUND
ETHYL GASOLINE CORPORATION
Knocks out that knock

What Ethyl Gasoline does

If your car is designed to operate on ordinary gasoline, the use of Ethyl Gasoline will:

Eliminate "that knock" and power loss.

Make carbon deposits a source of extra power. For carbon increases compression and Ethyl Gasoline is the high compression fuel.

Give a smoother and better pulling engine.

Reduce gear-shifting and increase acceleration, thereby making traffic driving easier.

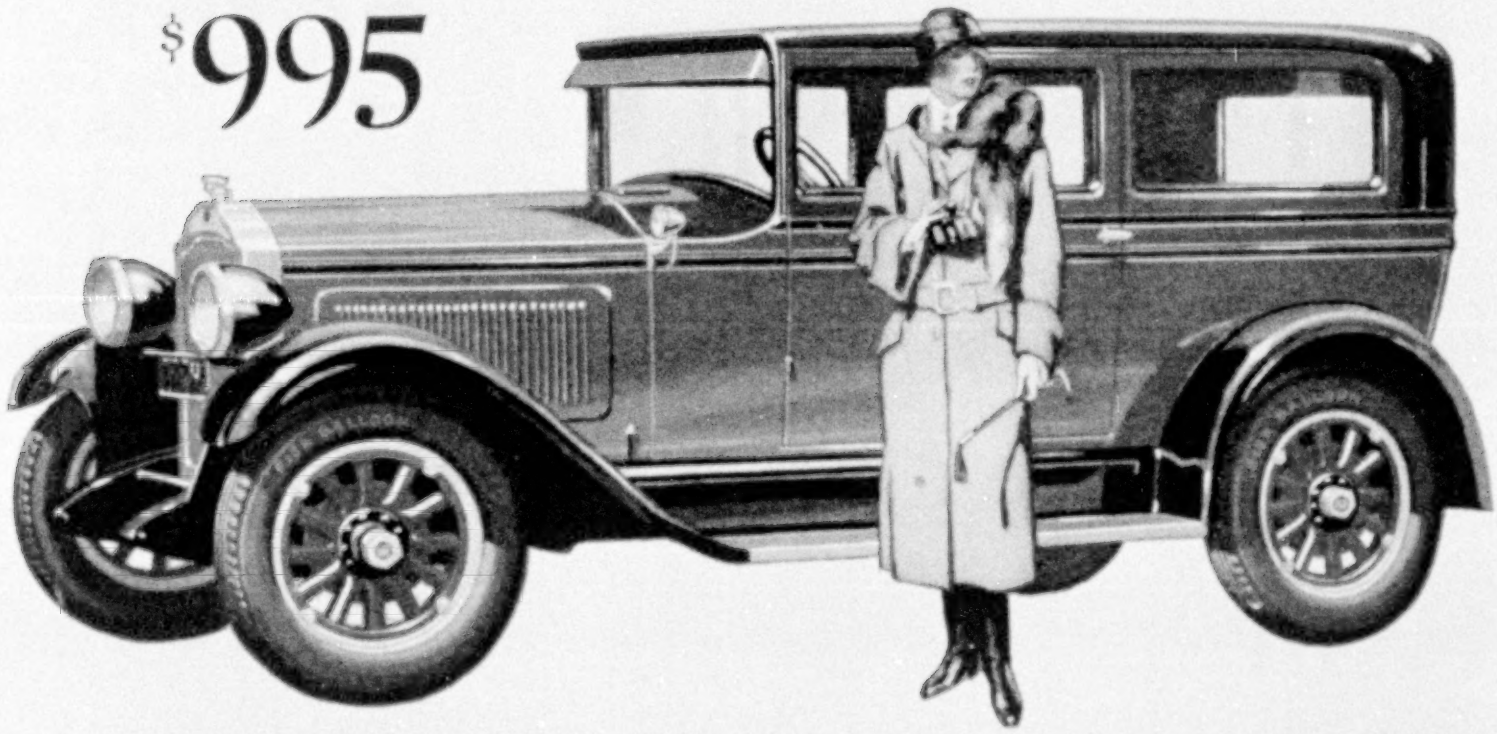
Cut down vibration, thereby reducing engine wear and tear and depreciation.

Save you the expense of carbon removal and other repairs caused by "knocking" and carbon formation.

Give more power per gallon for your fuel bills—and more mileage as compression is increased by carbon deposits.

If your car is a high compression car, just remember that Ethyl made it possible and is necessary to obtain maximum performance.

New
Standard Six
only
$995



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Nor is this record low price by any means the only factor to be considered. The Standard Six maintains all the quality supremacy of costlier Willys-Knights. Its *patented* high compression double-sleeve-valve engine, with 7-bearing crankshaft, is notable for the same velvet smoothness, silent power and rugged stamina which have won the praise of hundreds of thousands of enthusiastic Willys-Knight owners. By all means, be sure to see this beautiful car. You will admire its low, graceful lines, its richness of color, its spacious and tastefully appointed interior.

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It will be used during the ceremony.

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They will treasure it more and more as years pass and it will constantly remind them of your thoughtfulness.

Can't you imagine their gratitude? Do you think that any gift will be as precious to them as movies of their wedding? How delighted they will be to show them to those friends who could not be there. How delighted they will be to show them later on to their children. How they will love to look at those wedding and honeymoon films when youth has gone!

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Suggest that they begin taking pictures at once. The bride and groom by a window . . . before leaving the house (the Ciné-Kodak, *f*.1.9, for example, takes wonderful interior pictures). The bride as she alights from the car in front of the church. The guests as they enter or leave. The bridesmaids and ushers. The flower-girls. The reception afterward.

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Please send me, FREE and without obligation, the booklet telling me how I can easily make my own movies.

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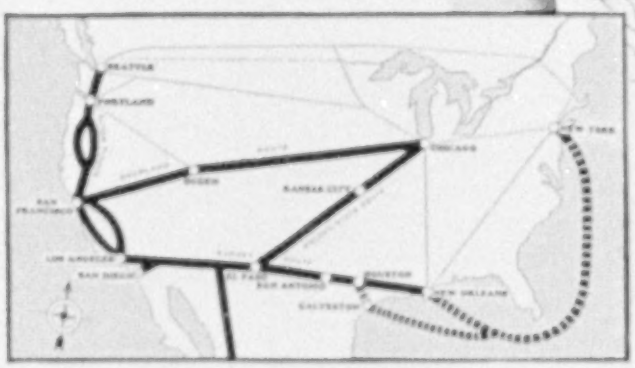

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In your regular vacation time this summer, take a round trip to California. Choice of three widely varied routes. Go one way, return another, The low summer *round-trip* fare is only fractionally more than regular *one-way*.

Or for about $20 more you can include a fourth route in your choice, going and returning, that will also enable you to tour Oregon, Washington and portions of Canada. You can stop over anywhere.

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The low round-trip tickets will be on sale from May 15 to September 30, return limit October 31. Southern Pacific agents are in most large cities. Your local railroad agent will also arrange a Pacific Coast trip over these scenic lines.

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CLOUDY WEATHER

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Now, all camera owners can buy Agfa film in America. *You* try it! You will get the finest pictures you have ever taken. *Agfa costs no more but it gives you more!*

How is Agfa better?

There are three distinct, scientific reasons why Agfa is a superfilm:

1. It is a *faster* film. This counteracts the natural tendency of the amateur to underexpose. It does away with pale, weak, lifeless pictures.

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Use any make or size of camera. Enter pictures in one or all of the following classes (1) Baby Pictures; (2) Rainy-Day Pictures; (3) Fair-Weather Pictures; and (4) Unusual Pictures. You have nothing to do but send in pictures...no story to write...no problems to solve. Just load up your camera and start it clicking... You have every chance to be a winner—no professional pictures are accepted! Get contest particulars where you buy film—or direct from us...see convenient coupon below! AGFA ANSCO CORPORATION, New York, N. Y. Binghamton, N. Y.

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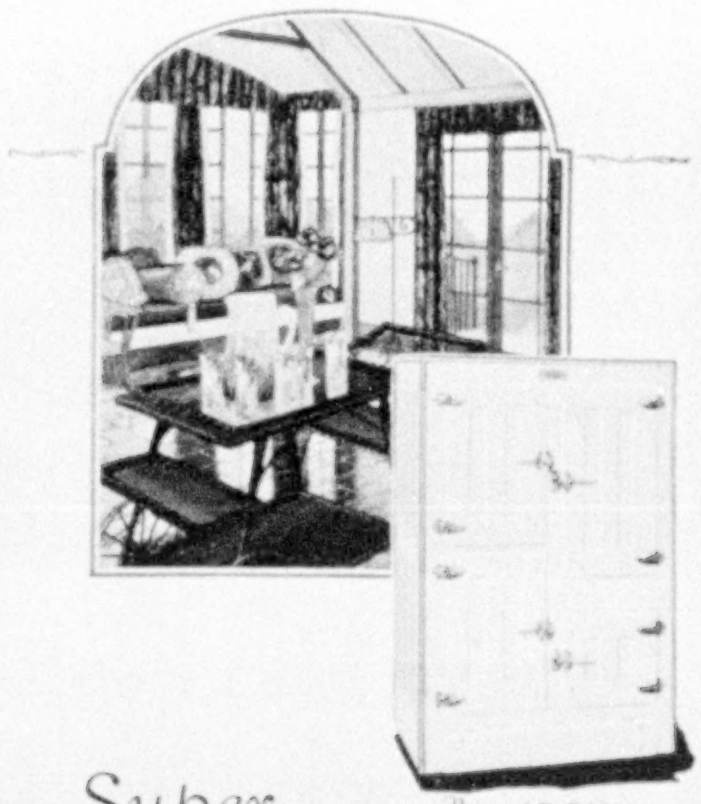

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Spaghetti! Tender, creamy curlicues in a happy scarlet sauce. Juicy, fresh-tasting tomato sauce, temptingly seasoned and spiced. That nippy, snappy cheese. Good! Isn't it though? And satisfying! This savory combination of delicious flavors — Heinz Cooked Spaghetti — *Italian* style — in tomato sauce with cheese — steaming hot.

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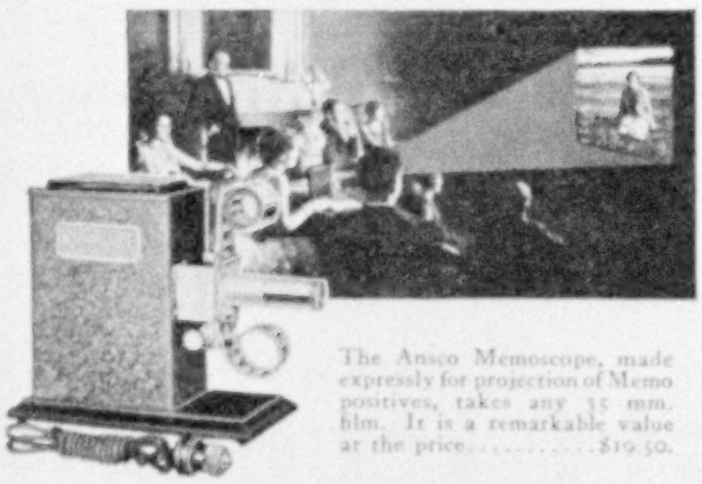

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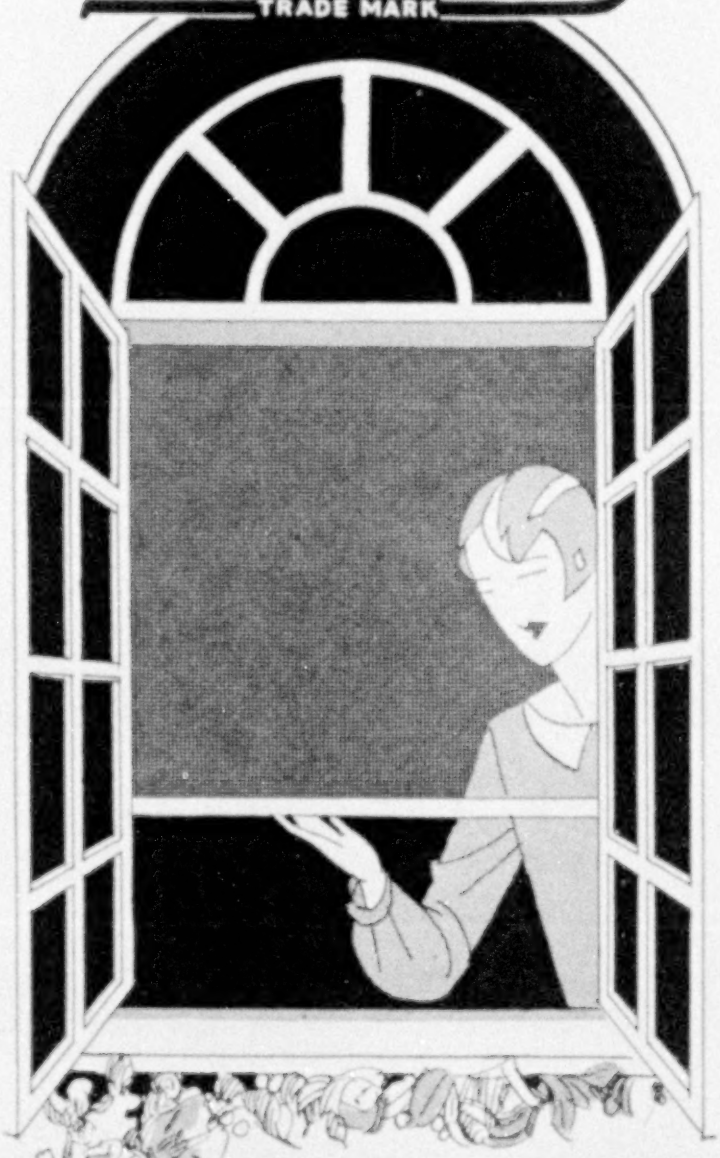

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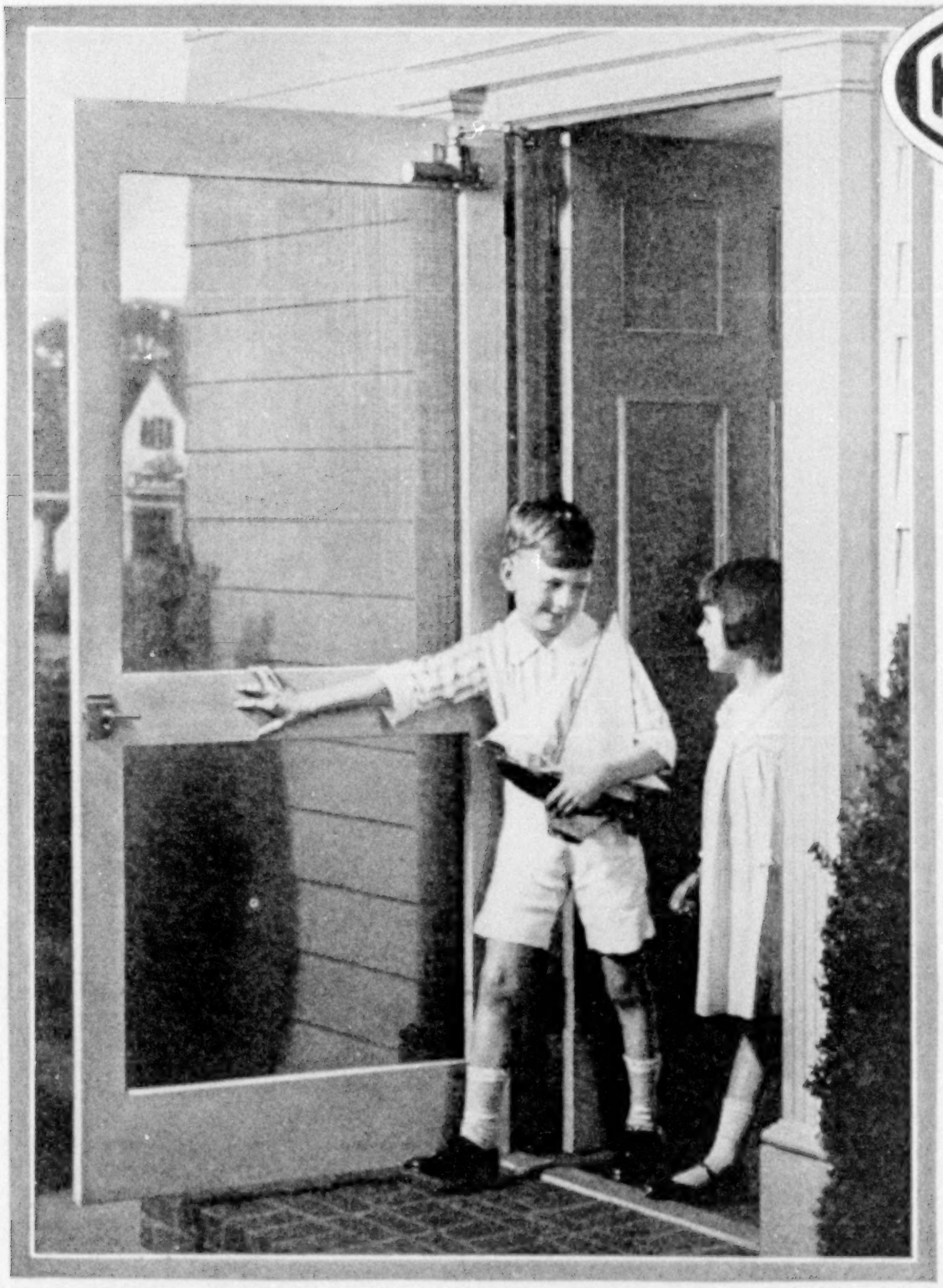

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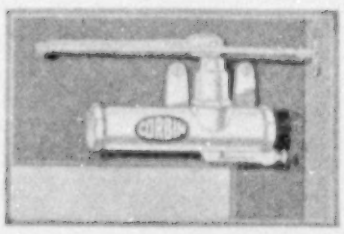

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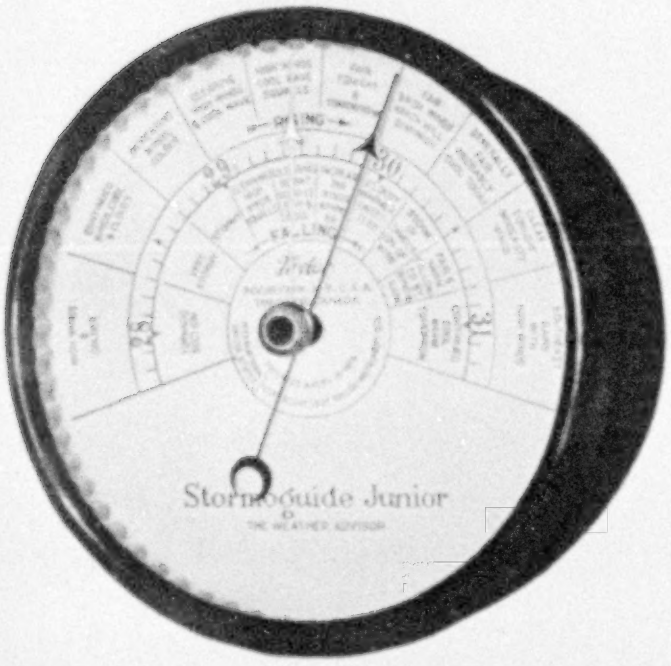

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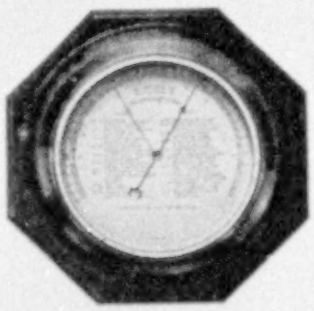

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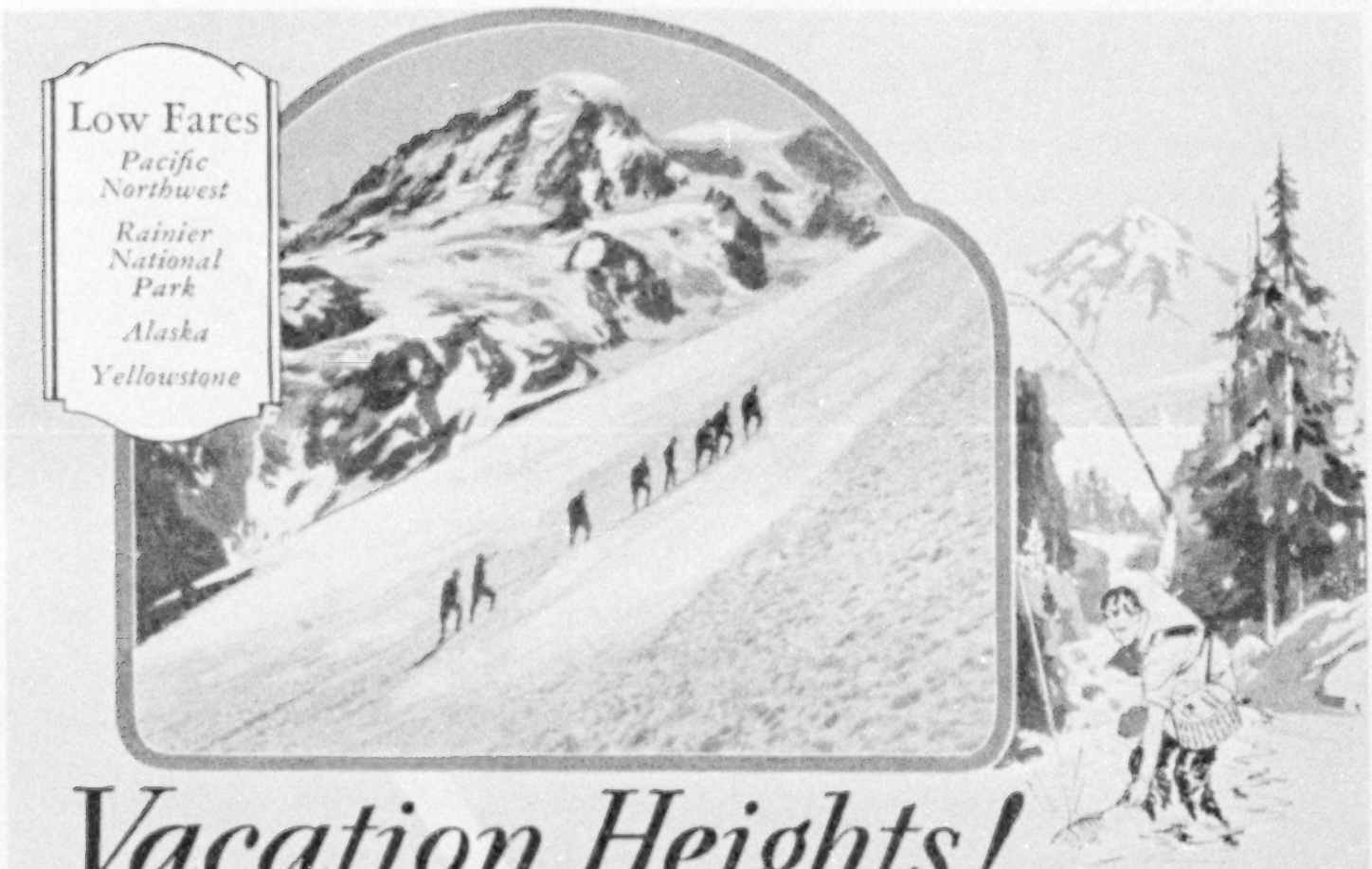

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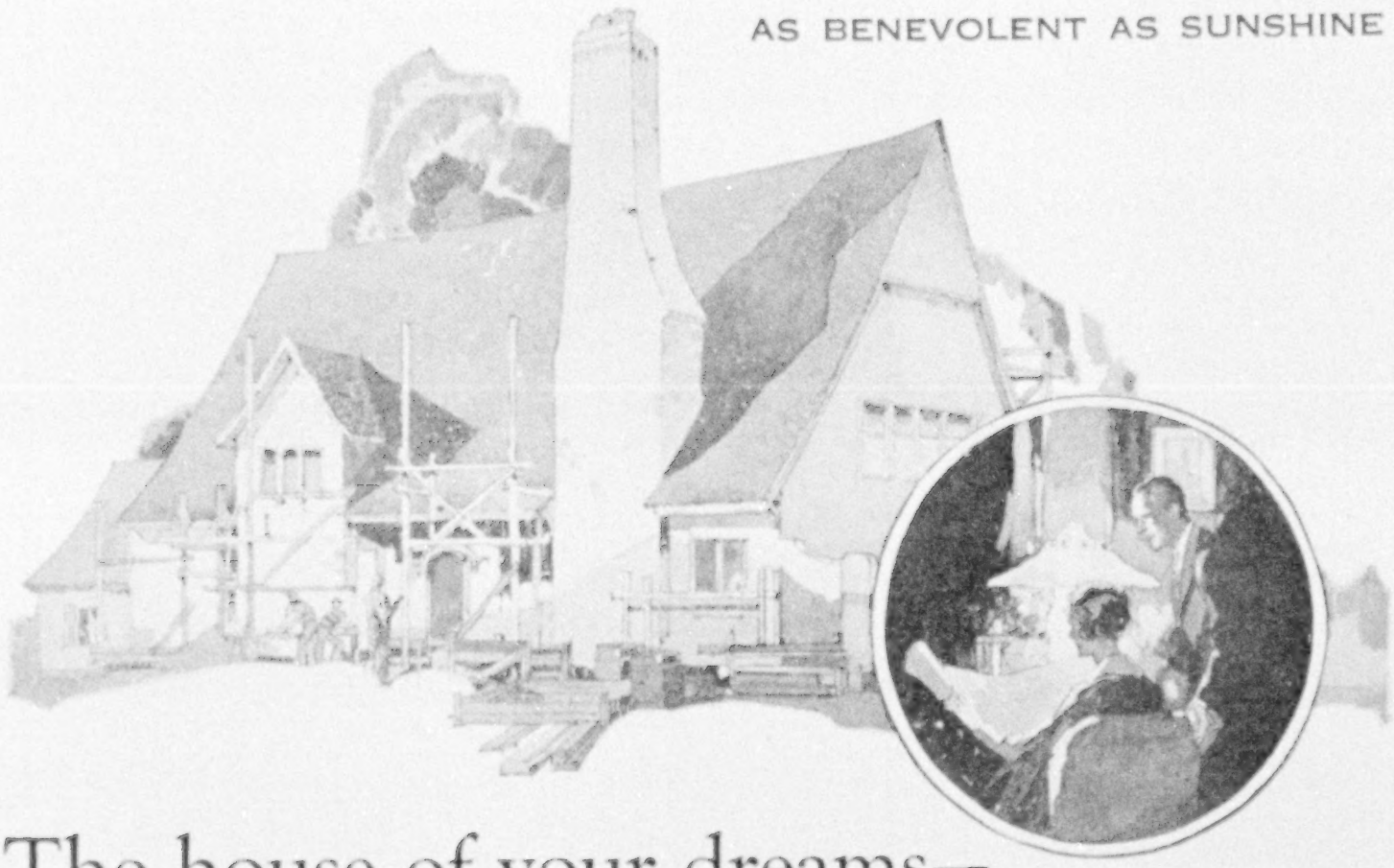

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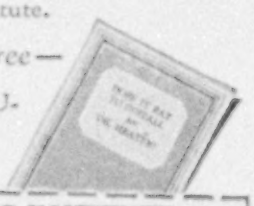

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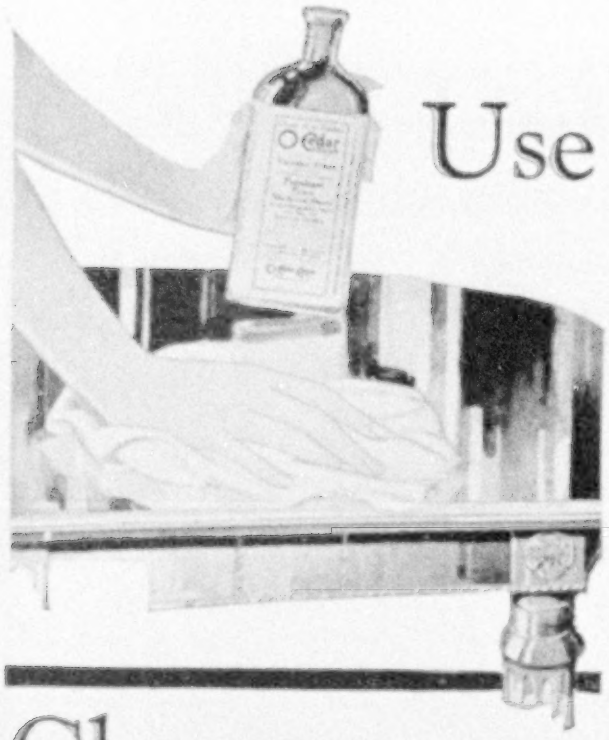

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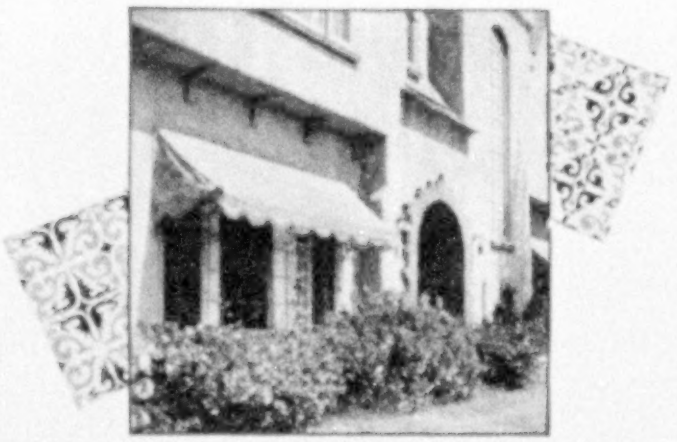

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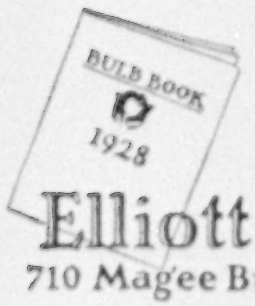

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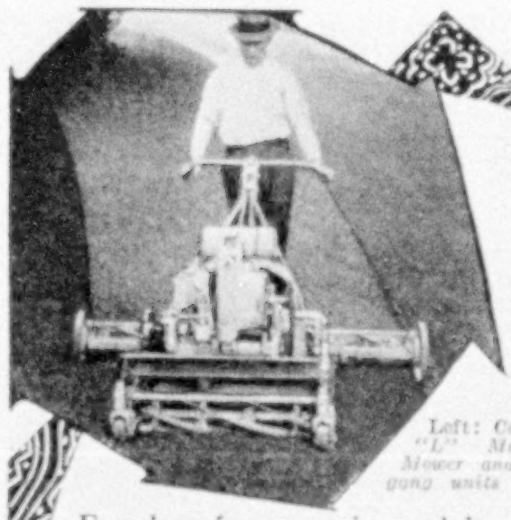

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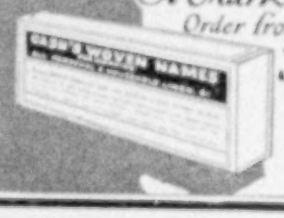

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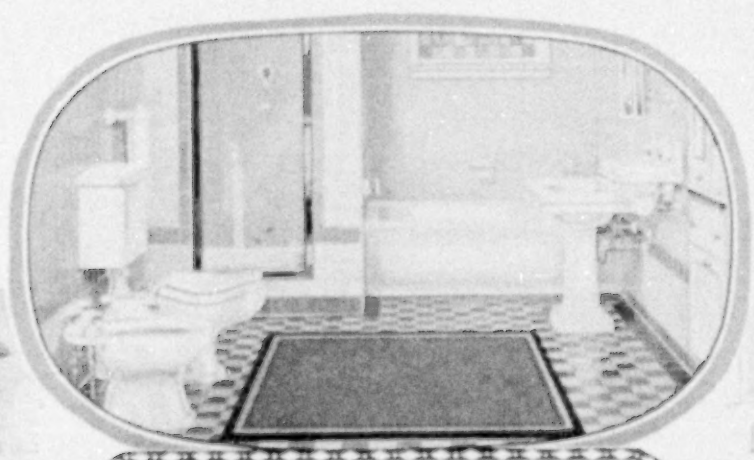

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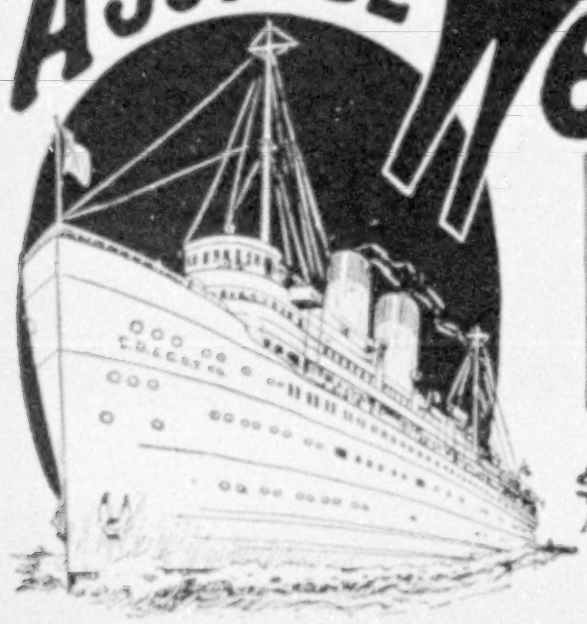

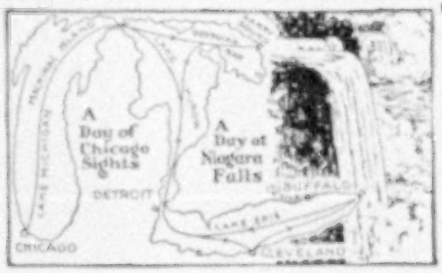

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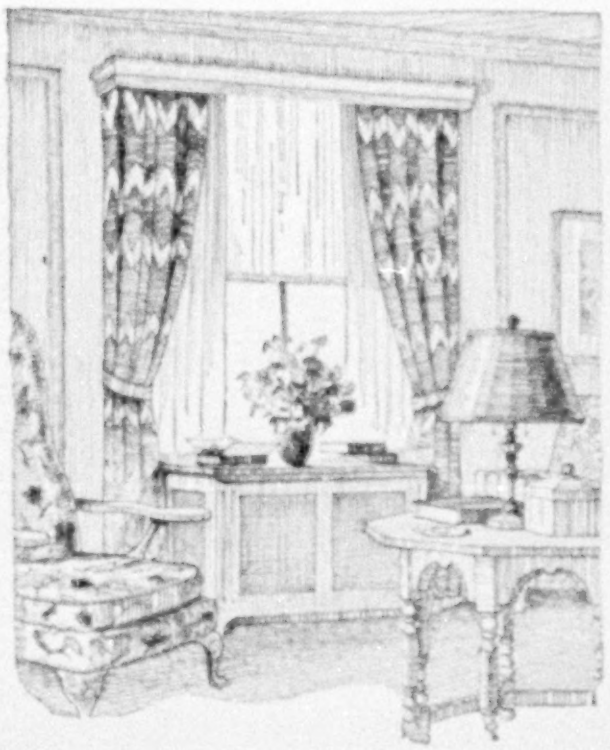

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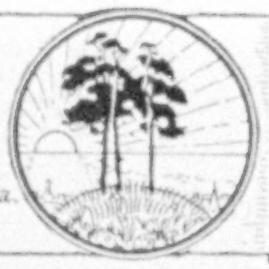

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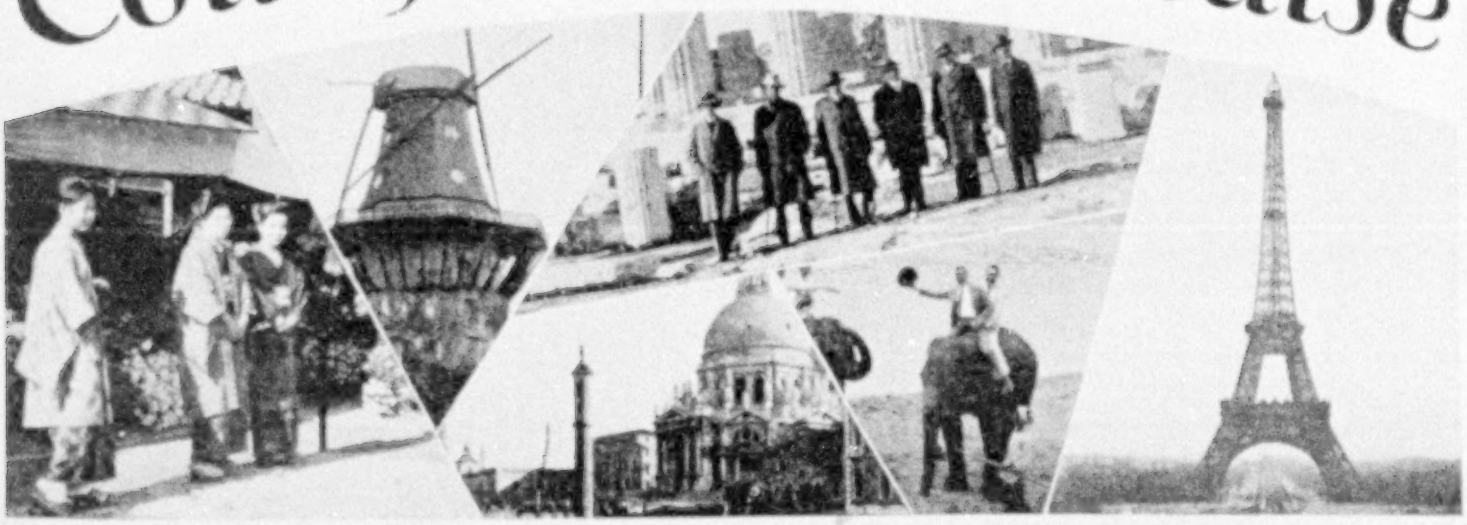

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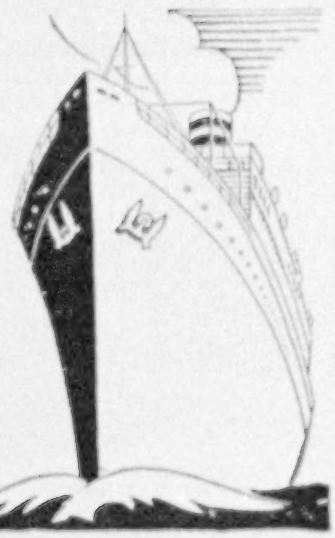

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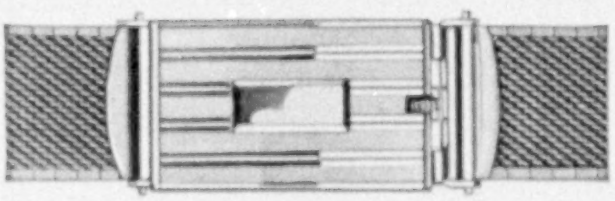
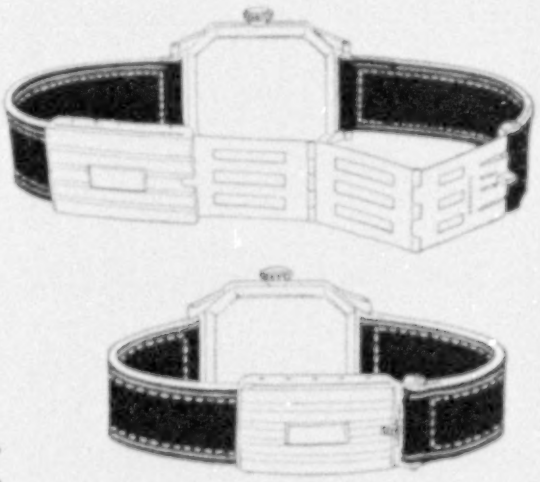


Various engraved designs, fitted with leather or flexible Milanaise mesh. Note illustration at right showing band expanded with ample allowance for passage of watch over hand.



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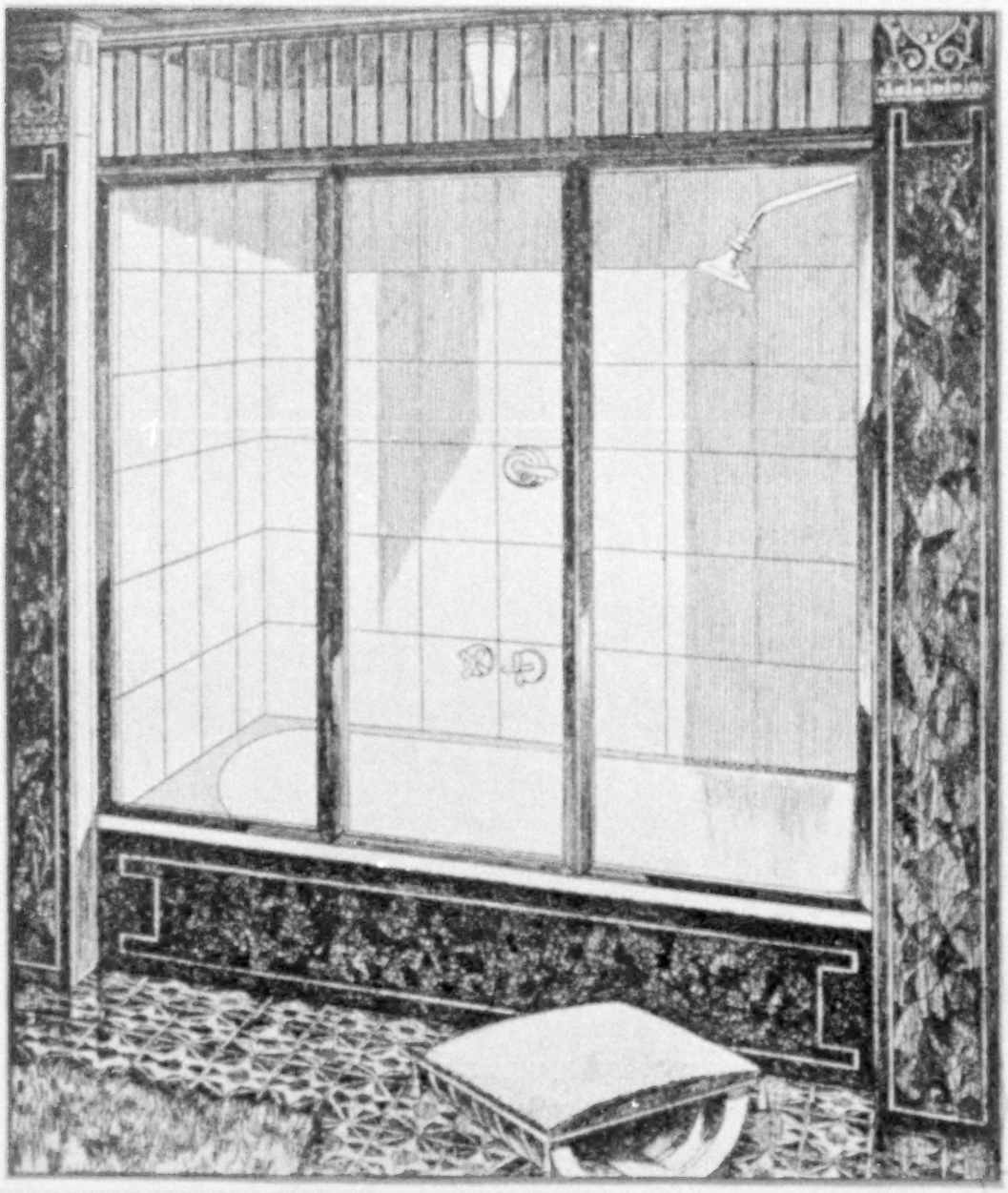

The Tarnia

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